

SmarTEST X Hardware Manual

SmarTEST X systems



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Moog FCS B.V.

P.O. Box 187

2150 AD Nieuw-Vennep

The Netherlands.

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1 SmarTEST X Control Overview

1.1 General Information

This manual has two main purposes:

1. It describes how to interface the SmarTEST ONE unit to customer's hardware
2. It describes all line replaceable units of the SmarTEST X controller. If a hardware change has to be made, this manual describes how it should be done.

All external connections (except for the keyboard) are made at the backside of the SmarTEST ONE unit.

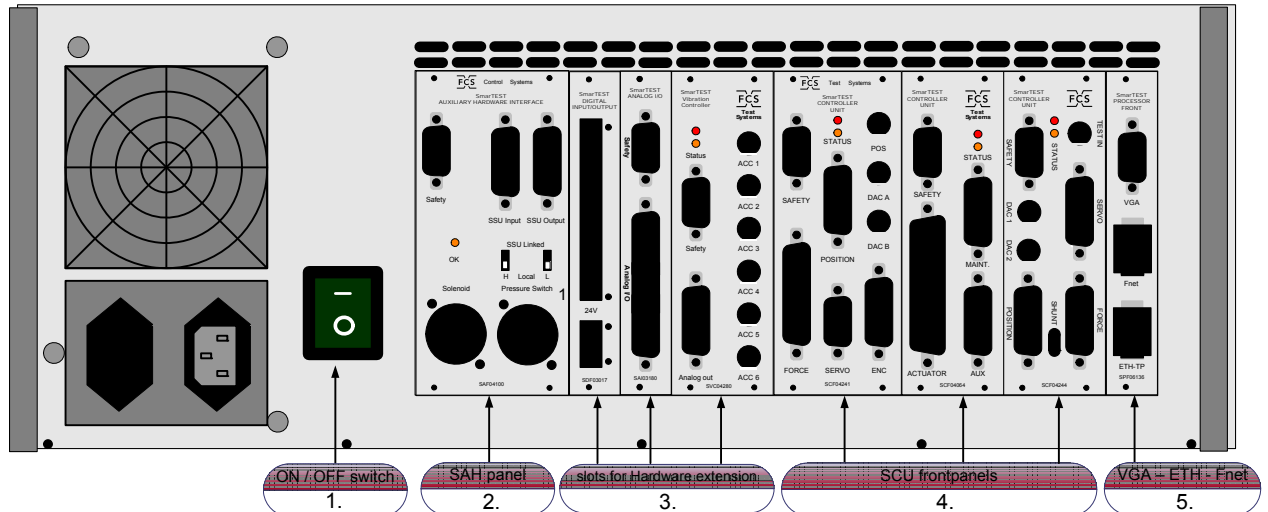


Figure 1.1 SmarTEST ONE backside

From left to right the following components can be identified:

1. ON/OFF switch.
2. SAH (SmarTEST Auxiliary Hardware) connection panel, used to interface with hydraulics. (**chapter 2**)
3. These slots can be used for hardware extensions. (**chapters 6,7,8,9**)
4. Up to four SmarTEST Controller Front panels. (**chapter 3**)
5. VGA, Fnet connectors and Ethernet interface

The power supply and on/off switch are default PC components and will not be further described.

The next chapters describe the hardware components.

2 SmarTEST Auxiliary Hardware Frontpanel

The SmarTEST Auxiliary Hardware Interface (p.n. SAF04100 also known as SAH panel) serves as the interface between the controller and hydraulics via a 5-pins solenoid output connector for low and high pressure (formerly 3-pins dump valve). In case of an emergency stop, failsafe status, hydraulic pressure drop or malfunction of one of the SCU's or SAH, this solenoid output connector will be disabled in order to shutdown the hydraulic pressure. For this, it is necessary to connect a safety cable to the safety connector of each SCU and of the SAH panel. A cable for 1 to 4 SCU's can be ordered.

Available SAH Safety cables to connect to the SmarTEST Controller Unit safety connectors:

- (part number SCA3019-501 to connect the SAH safety to 1 SCU safety connector
- (part number SCA3019-502 to connect the SAH safety to 2 SCU safety connectors
- (part number SCA3019-503 to connect the SAH safety to 3 SCU safety connectors
- (part number SCA3019-504 to connect the SAH safety to 4 SCU safety connectors

Furthermore an external link is available, which makes it possible to link several SAH panels together. This will make it possible to define a test with more control channels linked together in one large test. This option can be selected by the "Local" and "Linked" switches. A separate SmarTEST Safety Unit or extended hydraulic emergency button can be connected also. Finally the SAH panel also has a pressure switch input connector. This will be scanned at 2500 Hz as soon as it has been triggered by the pressure sensor. The solenoid output connector will be disabled in case the interruption is longer than 4 ms.



Figure 2.1 SmarTEST Auxiliary Hardware Frontpanel (SAF04100)

The procedure how to replace the fuses of the SAH is described is explained in [Appendix H](#)

2.1 SAH Safety

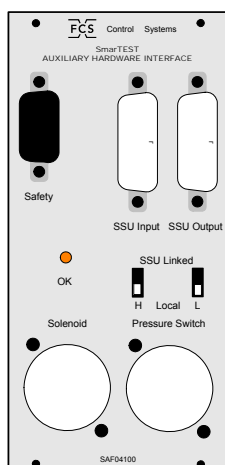


Table 2.1 Safety Connector

Pin	Signal Name	Signal Description
1	No_Ext_Fail_L	No_External_Failure (Low)
2	On_Request_L	On Request (Low)
3	GND	Ground
4	Ext_Power_On_H	External Power On (High)
5	SCU_OK_H	SCU OK (High)
6	Ext_Power_On_L	External Power On (Low)
7	SCU_OK_L	SCU OK (Low)
8	No_Ext_Fail_H	No_External_Failure (High)
9	On_Request_H	On Request (High)

Basically two lines are sensing the status of the controllers (SCU OK and SCU On Request) and the other two (No Ext Fail and Ext Power On) are connected to GND on the SAH to tell the controllers the status of the SAH. For each signal a clear explanation is given.

SCU OK
From the SAH a current of approx. 5 mA runs through the transistor side of an optocoupler on the controller via the controller front. If the SCU has no problems and the software is running, the optocoupler will conduct and the current will run to the next controller. If there is one SCU which is not OK the whole SCU OK line will be "Low."

SCU On Request
This will be detected on the SAH and if so, the solenoid output connector can not be enabled. From the SAH a current of approx. 5 mA runs through the transistor side of an optocoupler on the controller via the controller front. If the hardware will be activated and the other 3 lines are high, the SCU On Request will become high. After this step the solenoid output connector will be enabled in order to run the system with low or high hydraulic pressure.

No External Fail
From the SAH a current of approx. 5 mA runs through the transistor side of an optocoupler on the controller via the controller front. The controller detects this signal and then knows that there is no external failure. If the SAH is not OK this line will be low and the SCU will not generate an On Request.

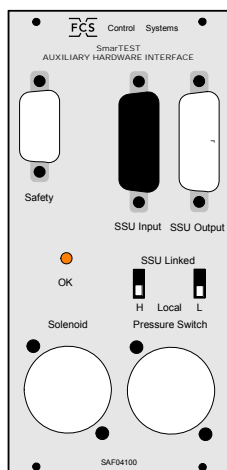
No External Fail
From the SAH a current of approx. 5 mA runs through the transistor side of an optocoupler on the controller via the controller front. The controller detects this signal and then knows that the external equipment (SAH) is powered. If the SAH is not OK this line will be low and the SCU will not generate an On Request.

2.2 SSU Input / Output

The SSU Input/Output connectors are only used if the SmarTEST ONE unit is integrated into a bigger SmarTEST system. It is used to link the safety signals to the central safety system. Please refer to the SmarTEST manuals for a description on the working of the SSU system.

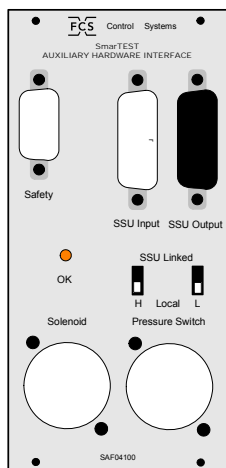
Table 2.2 SSU Input (15-Pins Sub-D Male Connector)

Pin	Signal Name	Signal Description
1	+24V SSU	Supply +24V (supplied to all SAH panels through SSU link)
2	+24V SSU	Supply +24V (supplied to all SAH panels through SSU link)
3	On Sense H	On Sense Low (will be high if SCU ok and On Request are high)
4	DI H	Digital input high (for rest condition) [Dedicated to safety line]



Pin	Signal Name	Signal Description
5	DI L	Digital input low [Dedicated to safety line]
6	On Enable H	On enable low (enables SSR if emergency ring is OK)
7	GND SSU	Supply GND (supplied to all SAH panels through SSU link)
8	GND SSU	Supply GND (supplied to all SAH panels through SSU link)
9	+24V SSU	Supply +24V (supplied to all SAH panels through SSU link)
10	+24V SSU	Supply +24V (supplied to all SAH panels through SSU link)
11	NC	Not connected
12	No Ext Fail En H	No Ext Fail En Low (enables the safety signal to controller)
13	NC	Not Connected
14	GND SSU	Supply GND (supplied to all SAH panels through SSU link)
15	GND SSU	Supply GND (supplied to all SAH panels through SSU link)

Table 2.3 SSU Output (15-Pins Sub-D Female Connector)



Pin	Signal Name	Signal Description
1	+24V SSU	Supply +24V (supplied to all SAH panels through SSU link)
2	+24V SSU	Supply +24V (supplied to all SAH panels through SSU link)
3	On Sense L	On Sense Low (will be high if SCU ok and On Request are high)
4	DI H	Digital input high (for rest condition) [Dedicated to safety line]
5	DI L	Digital input low [Dedicated to safety line]
6	On Enable L	On enable low (enables SSR if emergency ring is OK)
7	GND SSU	Supply GND (supplied to all SAH panels through SSU link)
8	GND SSU	Supply GND (supplied to all SAH panels through SSU link)
9	+24V SSU	Supply +24V (supplied to all SAH panels through SSU link)
10	+24V SSU	Supply +24V (supplied to all SAH panels through SSU link)
11	NC	Not connected
12	No Ext Fail En L	No Ext Fail En Low (enables the safety signal to controller)
13	NC	Not Connected
14	GND SSU	Supply GND (supplied to all SAH panels through SSU link)
15	GND SSU	Supply GND (supplied to all SAH panels through SSU link)

2.3 SSU Linked: L Local H

When multiple SAH's are configured in the same test or an external E-stop is needed, the SSU link can be used for this. All the SAH's in a test can be linked together in series and at the end a terminator or E-stop can be connected which will terminate (or close) the link.

An external Normally Closed (NC) Contact can be used for external E-stops. Opening this contact generates a failsafe, just like pushing the emergency stop on the front panel of the STO. The following pictures explain the configuration:

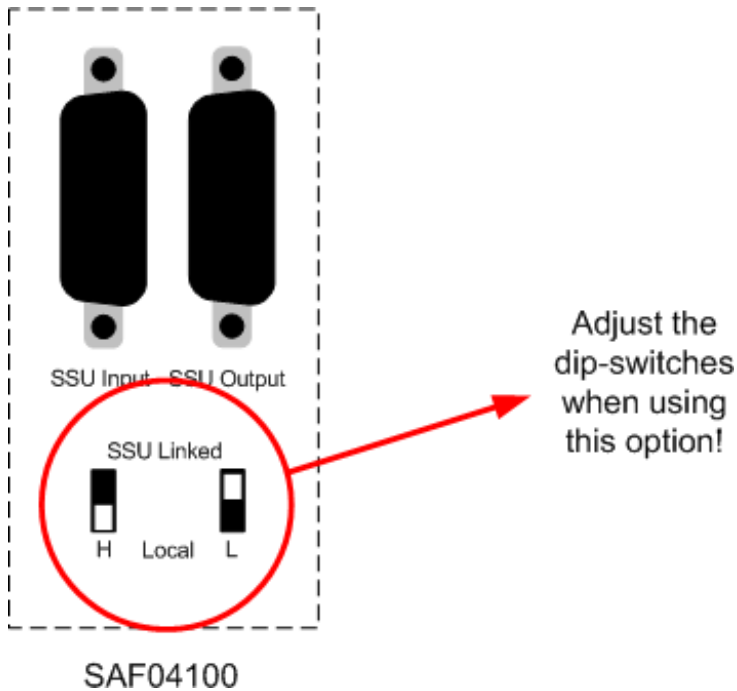


Figure 2.2 SmarTEST SAH (SAF04100) configured for E-stop

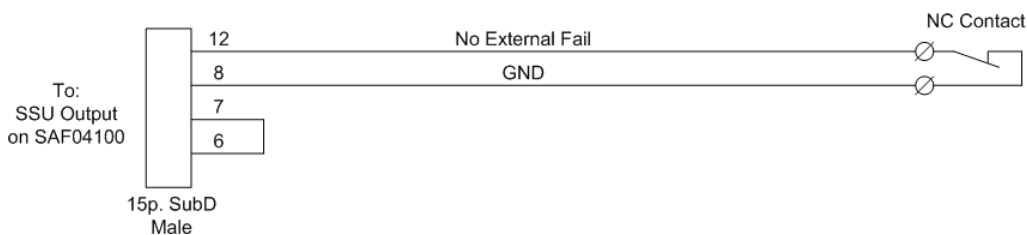


Figure 2.3 pins for SSU output on SAF04100 (configured for E-stop)

2.4 Solenoid Output Connector for Low / High Pressure

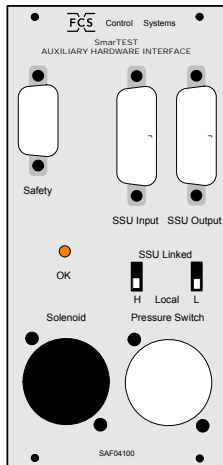


Table 2.4 Pin Setting Solenoid Output Connector

Pin	Signal Name	Signal Description
1	LOW	Low Pressure VALVE Supply +24V (Fused 2A each)
2	LOW R	Low Pressure Return, VALVE Supply GND
3	HIGH	High Pressure VALVE Supply +24V (Fused 2A each)
4	HIGH R	High Pressure Return, VALVE Supply GND
5	NC	Not connected

NOTE This 5-pins solenoid output connector was formerly a 3-pins dump valve.

2.5 Dump Valve On / Off

Table 2.5 Pin Setting Dump Valve On / Off

Pin	Signal Name	Signal Description
1	VALVE+	VALVE Supply +24V (Fused 2A each)
2	GND	VALVE Supply GND
3	NC	Not Connected

2.6 Pressure Switch

Furthermore the SAF panel has a pressure switch input connector available. This will be scanned at the pre-defined controller frequency (default: 2500 Hz) as soon as it has been triggered by the pressure sensor. The solenoid output connector will be disabled in case the interruption is longer than 4 ms.

A terminator connector (pressure switch terminator with p.n.: SCA03199-501) on the pressure switch connection of the SAF is not necessary, but is part of the delivery

NOTE Previous deliveries sometimes did not include the pressure switch terminator connector.

If the hydraulic manifold or actuator contains a pressure switch, the terminator connector (p.n.: SCA03199-501) can be modified by the operator such that this can interface with the pressure switch.

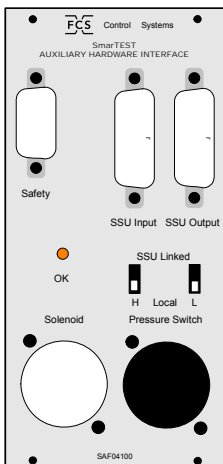


Table 2.6 Pin Setting Pressure Switch

Pin	Signal Name	Signal Description
1	PRESSURE_H	Pressure Switch HIGH
2	PRESSURE_L	Pressure Switch LOW
3	NC	Not Connected

3 SmarTEST Controller Boards

The SmarTEST Controller Unit (SCU) is an I/O card, which comprises transducer conditioning electronics and additional interfaces for controlling servo hydraulic actuators or electric actuators. The Processor Module executes MOOG FCS' unique force-loop algorithm for all channels in the chassis. The controller can be placed in the control room or near the actuator itself. The SCU offers two input channels for load cells (usually 350Ohm) and one for either an LVDT or a potentiometer. (For an example of the connection from the SCU to a 120 Ω load cell see Appendix D). A 16-bit D/A converter controls the servo valve and two general-purpose user programmable D/A converters are available for maintenance, installation and troubleshooting. During normal operation, the actual force performed on the test article is measured by the force transducer on the actuator, and registered by the controller loop where it is then compared to the commanded force signal. The control loop controls the actuator in such a way that the measured force is equivalent to the commanded force over a large frequency bandwidth.

Besides force control, the SCU can also be used in position loop control and pressure loop control, depending on the application.

The control loop parameters are all software adjustable. Potentiometers are not required for adjusting the SCU, not even for calibration.

The SCU performs a self-test at startup by connecting the DAC outputs internally to the DAC force inputs. Because of this both the DAC outputs and the DAC inputs are checked for correct reading. The excitation voltage of the force A and force B bridges is monitored independently. The feedback signals may be directly monitored via the SCU maintenance connector at the programmable DA converters. These signals are updated at the controller frequency (default: 2500 Hz).

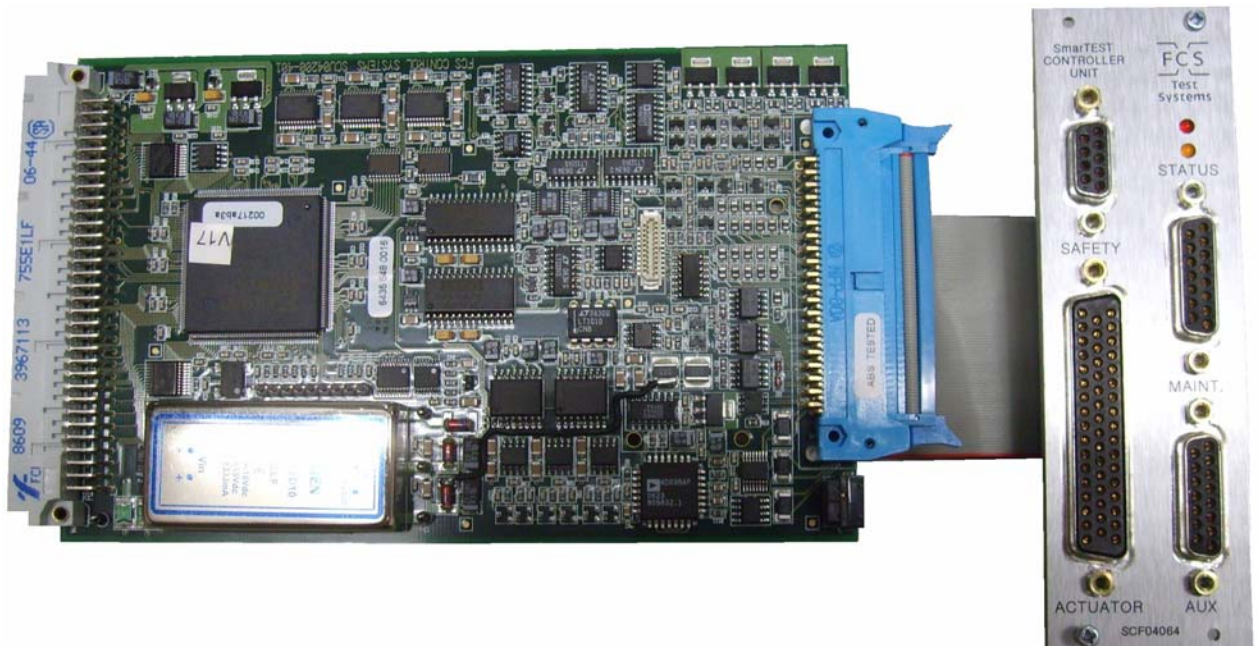


Figure 3.1 The SCU card complete with flat cable and front panel

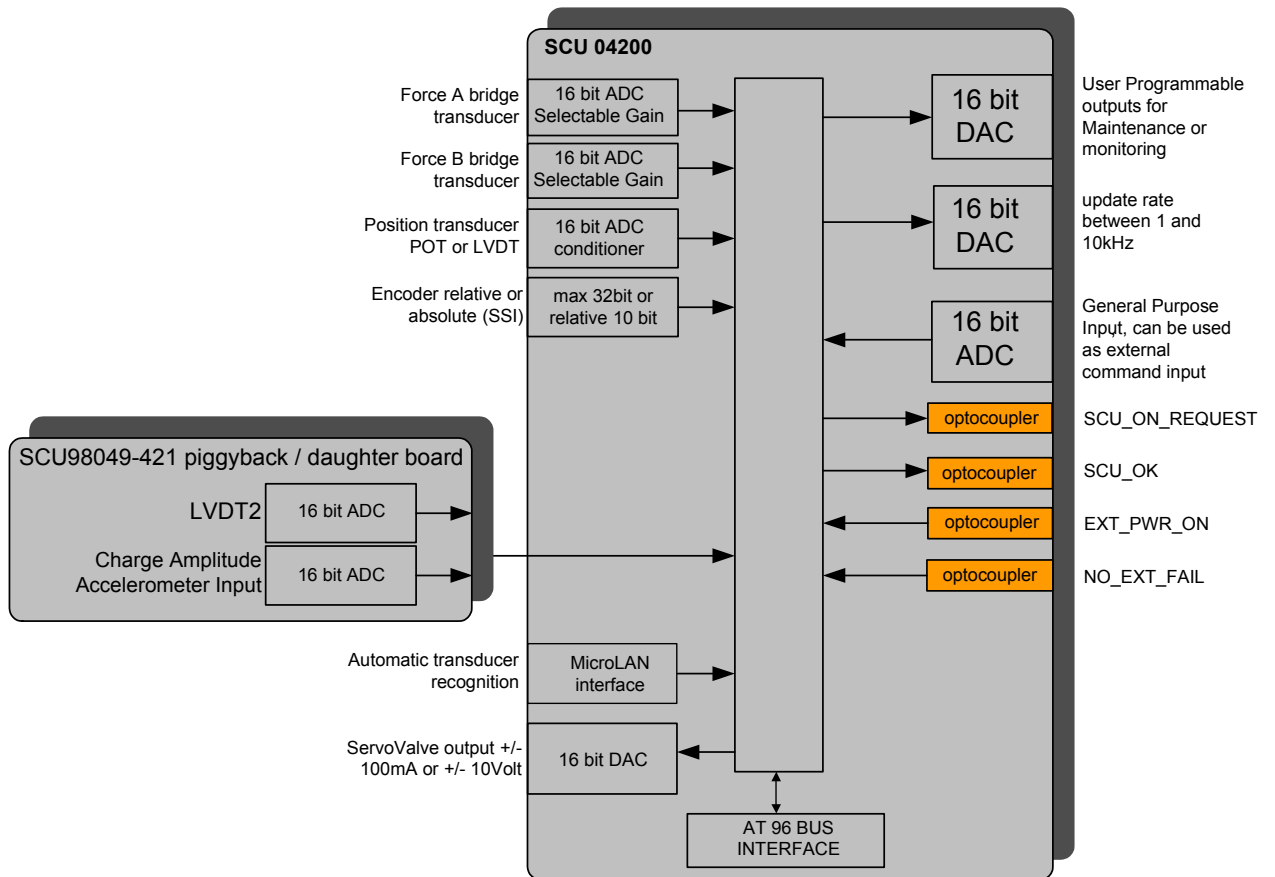


Figure 3.2 I/O Diagram of the SCU

3.1 SCU Safety

A safety system, using both hardware and software, is included in the SCU and is active in all selectable loops. The safety system determines whether:

- (The difference between command signal and measured force is less than a pre-set value.
- (The measured force does not exceed a pre-set value.
- (The difference between force 1 and force 2 (of a dual bridge load cell) is less than a pre-set value.
- (Other safety limits are not exceeded.
- (The internal power supply is within tolerance.
- (The SCU software is iterating properly.

Upon a safety system trip, the digital outputs SCU ON and SCU OK will be deactivated. These are connected to the SAH which will switch off the hydraulic or electric system. The SCU will start a self-test procedure.

Available SCU Safety cables to connect to the SAH Safety:

- (part number SCA3019-501 to connect the SAH safety to 1 SCU safety connector
- (part number SCA3019-502 to connect the SAH safety to 2 SCU safety connectors
- (part number SCA3019-503 to connect the SAH safety to 3 SCU safety connectors
- (part number SCA3019-504 to connect the SAH safety to 4 SCU safety connectors

3.2 SmarTEST Controller Fronts

Each SCU board has a front panel where all the in- and outputs are connected through different types of connectors. Moog FCS has different front panels available:

The SCF04064 front panel has one big connector which holds all the in- and outputs to the actuator.

The SCF04241 front panel has four separate connectors for the in- and outputs to the actuator; one for the force transducer, one for the position transducer, one for the encoder and one for the servo valve.

The SCF04244 front panel is designed as a replacement for MTS 458 controllers allowing easy upgrade from these old controllers.

The SCF98050 is the previous version of the SCF04064.

The SCF00018 is the previous version of the SCF04241.



SCF04064



SCF04241



SCF04244



SCF98050



SCF00018

3.2.1 SCF04064 SmarTEST Controller Front

The picture below is the SmarTEST Controller Front SCF04064 (replaces the SCF98050). On this front there is a 50-pins ACTUATOR connector (like with the SCF98050). The DAC 1 & 2 (BNC connectors) are replaced by an auxiliary connector.

On this front the following connections are defined:

- (Safety (9 Pins Sub-D Socket)
- (Actuator (50 Pins Sub-D Socket)
- (Maintenance (15 Pins Sub-D Socket)
- (Auxiliary (15 Pins Sub-D Socket)

On the following pages the pin definition of the SCF04064 front is described.



Figure 3.3 SmarTEST Controller Front SCF04064

3.2.1.1 Safety Line Connector

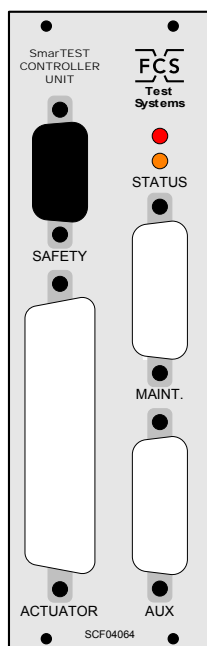
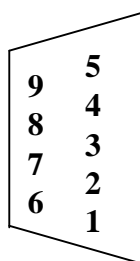


Table 3.1 SCU Safety Connector (9-pins socket Sub-D)

Pin	Signal name	Description
1	No_Ext_Fail_H	Supply input for No_External_Failure monitoring.
2	SCU_On_Req_H	Supply input for SCU_On_Request monitoring.
6	Ext_Pwr_On_H	Supply input for External_Power_On monitoring.
7	SCU_OK_H	Supply input for SCU_OK monitoring.
3	AGND	References external GND (from e.g SAH) to SCU GND.
4	Ext_Pwr_On_L	Output from SCU for External_Power_On monitoring.
5	SCU_OK_L	Output from SCU for SCU_OK monitoring.
8	No_Ext_Fail_L	Output from SCU for No_Ext_Fail monitoring.
9	SCU_On_Req_L	Output from SCU for SCU_On_Req monitoring.



SCU safety connector (9-pins Sub-D Socket)

3.2.1.2 Maintenance Connector

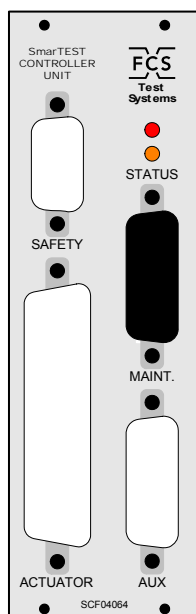
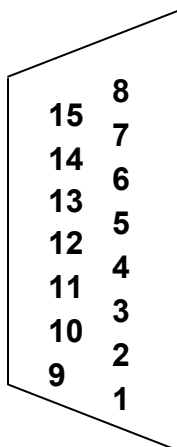


Table 3.2 SCU Maintenance Connector (15-pins socket Sub-D)

Pin	Signal name	Description
1	+AD3	+ Test input (full range = ± 10 V)
2	-AD3	- Test input
4	PLOT_LC0	High-resolution 1 (full range = ± 10 V)
1	AGND	Analog Ground
2		
3	PLOT_LC1	High-resolution 2 (full range = ± 10 V)
1	AGND	Analog Ground
1		
5	PLOT_POS	Actuator position 1 (full range = ± 10 V)
1	AGND	Analog Ground
3		
6	+VDAC0	+ Selectable D/A converter A (full range = + 5 V)
7	-VDAC0	- Selectable D/A converter A (full range = - 5 V)
1	+VDAC2	+ Selectable D/A converter B (full range = + 5 V)
5		
8	-VDAC2	- Selectable D/A converter B (full range = - 5 V)
9	AGND	Analog Ground
1	AGND	Analog Ground
0		
1	AGND	Analog Ground
4		



SCU maintenance connector (15-pins Sub-D socket)

3.2.1.3 Actuator Connector

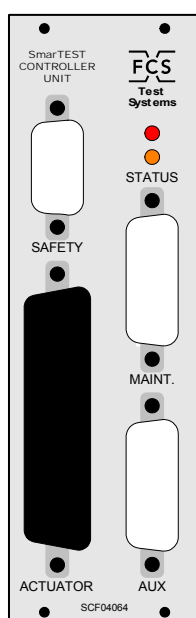


Table 3.3 SCU Actuator Connector (50-pins socket Sub-D)

Group	Pin	Signal name	Description
Force A	7	+E0	Excitation 5 V (max. 100 mA: min. LC impedance = 120 ohm)
	41	-E0	Excitation return -5 V (max. 100 mA)
	24	+S0	Excitation sense 5 V
	25	-S0	Excitation sense return -5 V
	40	+A0	+ Input Force A (H/W gain 1x, 125x, 250x,
	8	-A0	- Input Force A
	9	AGND	Analog ground Force A
Force B	5	+E1	Excitation 5 V (max. 100 mA: min. LC
	39	-E1	Excitation return -5 V (max. 100 mA)
	22	+S1	Excitation sense 5 V
	23	-S1	Excitation sense return -5 V
	38	+A1	+ Input Force B (H/W gain 1x, 125x, 250x,
	6	-A1	- Input Force B
	37	AGND	Analog ground Force B
Position	34	LVDT_EXC1	LVDT Excitation High (10V _{peak} @ 3kHz)
	2	LVDT_EXC2	LVDT Excitation Low
	3	AGND	Analog ground
	19	LVDT_VA	LVDT in (software selectable), max LVDT
	35	LVDT_VB	LVDT Signal Return
	11	VPOT	VPOT input (software selectable)
	43	+VREFPOT	Potmeter excitation 5 V (max. 5 mA)
	28	-VREFPOT	Potmeter excitation return -5 V (max. 5 mA)
Servo	42	+ISERVO	Current output High (max. ± 100 mA)
	26	-ISERVO	Current output Low (max. +/- 100mA)
	27	+VSERVO*	Voltage output High (± 10 V)
	10	-VSERVO*	Voltage output Low (± 10 V)
Encoder	48	ENCODERCLK	Encoder Clock
	16	ENCODERINDEX	Encoder Index
	33	ENCODERDATA	Encoder Data
	49	NENCODERCLK	Inv Encoder Clock

50	33	17
49	32	16
48	31	15
47	30	14
46	29	13
45	28	12
44	27	11
43	26	10
42	25	9
41	24	8
40	23	7
39	22	6
38	21	5
37	20	4
36	19	3
35	18	2
34	17	1

Group	Pin	Signal name	Description
	17	NENCODERINDEX	Inv Encoder Index
	50	NENCODERDATA	Inv Encoder Data
Test In	29	+AD3	+ Test input (full range = ± 10 V)
	45	-AD3	- Test input
Dig. In	13	+OPTIN	Supply optocoupler diode
	30	-OPTIN	Return optocoupler diode
Dig. Out	46	+OPTOUT	Collector optocoupler transistor
	14	-OPTOUT	Emitter optocoupler transistor
Safety	15	-BYPASS	ON_REQ out
	32	-HOOFDKLEP	SCU_OK out
	47	-DRUKSENSE	EXT_PWR_ON out
	31	-ERRMAN	NO_EXT_FAIL out
μ-LAN	21	1WDATA	μ -LAN
	4	1WRET	μ -LAN Return
Supply	18	12VFUSED	12V power supply (0.5A)
	1	GND	Digital Ground for encoders
	12	5VFUSED	5V power supply (0.5A)
	44	GND	Digital Ground for encoders
Ground	36	CGND	Chassis Ground
	20	AGND	Analog Ground

NOTE

* When the Vservo output of an SCU is used, the Iservo needs to be shorted (Iservo+ and Iservo- need to be connected).
If this is not performed, the Vservo output will be limited to ± 3.5 Volts, while it should be ± 10 Volt.

See [Appendix F](#) for example of the actuator cable

3.2.1.4 Auxiliary Connector

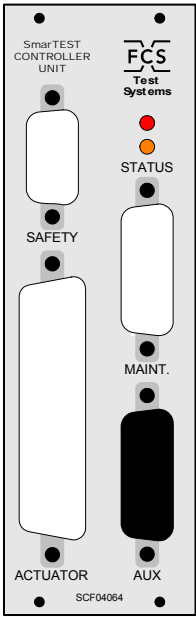
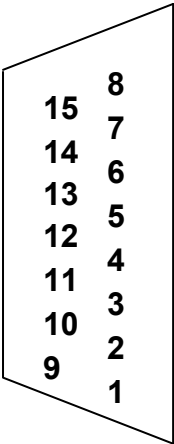


Table 3.4 SCU Auxiliary Connector (15-pins socket Sub-D)

Pin	Signal name	Description
1	NC	Not Connected
2	NC	Not Connected
3	NC	Not Connected
4	NC	Not Connected
5	NC	Not Connected
7	LVDT_EXC1	LVDT2 Excitation High (10V _{peak} @ 3kHz)
15	LVDT_EXC2	LVDT2 Excitation Low
8	AGND	LVDT2 Coil reference
6	LVDT2_VA	LVDT2 in (software selectable)
14	LVDT2_VB	LVDT Signal Return
9	1 WDATA	μ-LAN
10	1 WRET	μ-LAN Return
11	GND	Ground
12	ICP+	Charge Amplitude /Accelerometer Input
13	ICP-	Charge Amplitude/Accelerometer Return

Please note that both ICP® and LVDT2 are only available on the piggyback of the SCU



SCU Auxiliary connector (15-pins Sub-D socket)

3.2.1.5 Programmable out puts

The VDAC0 and VDAC2 (also called DAC A and DAC B) signals can be programmed to output any of the signals listed in the table below using the SmarTEST software. For a complete description see the User Manual for software v1.8.2.

Table 3.5 SCU signals available in software

Mnemonic	Signal Name	Signal Description
Acc	Acceleration	Predicted acceleration, computed in the model follower algorithm of the Force Loop
V _c	Computed Velocity	Predicted velocity, computed in the model follower algorithm of the Force Loop
V _a	Actual velocity	Velocity measured, differentiated from the position input
X _c	Computed position	Predicted position, computed in the model follower algorithm of the Force Loop
X _a	Actual position	Measured position
I _{sv}	Servo valve current	Commanded servo valve current
F _c	Commanded force	The force command signal
F _a	Force A	Measured force on the first bridge of the load cell
V _{c va}	Velocity error	Difference between the computed velocity and the actual velocity
X _{c xa}	Position error	Difference between the computed position and the actual position
F _{a lp}	Actual force, low pass filtered	Same as F _a , but smoother because of a low pass "de-spike" filter
V _{a lp}	Actual velocity, low pass filtered	Same as V _a , but smoother because of a low pass "de-spike" filter
V _{diff lp}	Differentiated velocity, low pass filtered	Derivative of V _{a lp} (= acceleration), which is calculated by the software. The signal is low pass "de-spike" filtered.
X _{diff lp}	Differentiated position, low pass filtered	Derivative of V _{a lp} (= velocity), which is calculated by the software. The signal is low pass "de-spike" filtered.
F _{c dot}	Differentiated Force	Force signal used by the feed-forward gain.
F _b	Force B	Measured force on the second bridge of the load cell
F _{a fb}	Bridge error	Difference between bridge A and bridge B of the load cell.
J _p	Commanded position	The position command signal
F _{c fa}	Force following error	Difference between command and force feedback
Offset 0 V	Test signal	Offset of the DAC + 0 V
Offset -5 V	Test signal	Offset of the DAC - 5 V
Offset+5 V	Test signal	Offset of the DAC + 5 V

3.2.2 SCF04241 SmarTEST Controller Front

The picture below is the SmarTEST Controller Front SCF04241 (formerly SCF00018). On this front the 50-pins ACTUATOR connector is divided in 4 separate connectors: Force, Position, Servo and Encoder.

On this front the following connections are defined:

- (Safety (9 Pins Sub-D Socket)
- (Force (25 Pins Sub-D Socket)
- (Position (15 Pins Sub-D Socket)
- (Servo (9 Pins Sub-D Socket)
- (Encoder (15 Pins Sub-D Socket)
- (Pos, DAC A and DAC B (BNC Panel Sockets)

On the following pages the pin definition of the SCF04241 front is described.



Figure 3.4 SmarTEST Controller Front SCF04241

3.2.2.1 Safety Connector

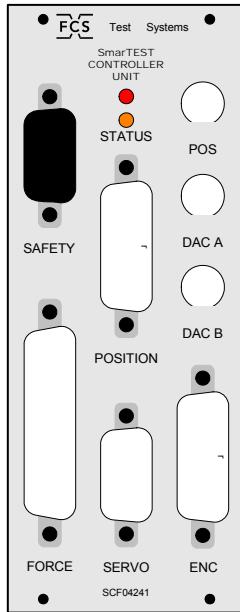
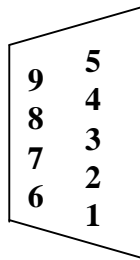


Table 3.6 SCU Safety Connector (9-pins socket Sub-D)

Pin	Signal name	Description
1	No_Ext_Fail_H	Supply input for No_External_Failure monitoring.
2	SCU_On_Req_H	Supply input for SCU_On_Request monitoring.
6	Ext_Pwr_On_H	Supply input for External_Power_On monitoring.
7	SCU_OK_H	Supply input for SCU_OK monitoring.
3	AGND	References external GND (from e.g SAH) to SCU GND.
4	Ext_Pwr_On_L	Output from SCU for External_Power_On monitoring.
5	SCU_OK_L	Output from SCU for SCU_OK monitoring.
8	No_Ext_Fail_L	Output from SCU for No_Ext_Fail monitoring.
9	SCU_On_Req_L	Output from SCU for SCU_On_Req monitoring.



SCU safety connector (9-pins Sub-D Socket).

3.2.2.2 Servo Valve Connector

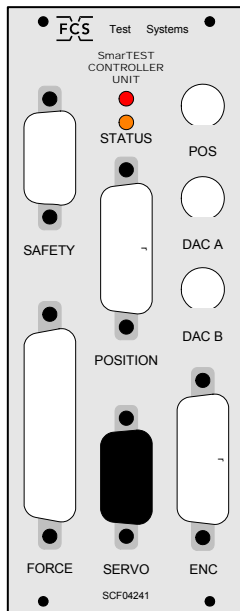
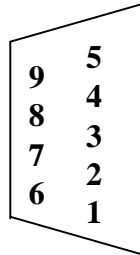


Table 3.7 SCU Servo Connector (9-pins socket Sub-D)

Pin	Signal name	Description
1	-ISERVO	Current output Low (max. +/- 100mA)
2	+ISERVO	Current output High (max. \pm 100 mA)
3	AGND	LVDT2 Coil reference
4	LVDT2_EXC1	LVDT2 Excitation High (10V _{peak} @ 3kHz)
5	LVDT2_EXC2	LVDT2 Excitation Low
6	-VSERVO*	Voltage output Low (\pm 10 V)
7	+VSERVO*	Voltage output High (\pm 10 V)
8	LVDT2_VA	LVDT2 in (software selectable)
9	LVDT2_VB	LVDT2 Signal Return

Please note that LVDT2 is only available on the piggyback of the SCU



Servo connector (9-pins Sub-D socket)

NOTE * When the Vservo output of an SCU is used, the Iservo needs to be shorted (Iservo+ and Iservo- need to be connected).
If this is not performed, the Vservo output will be limited to ± 3.5 Volts, while it should be ± 10 Volt.

3.2.2.3 Position Connector

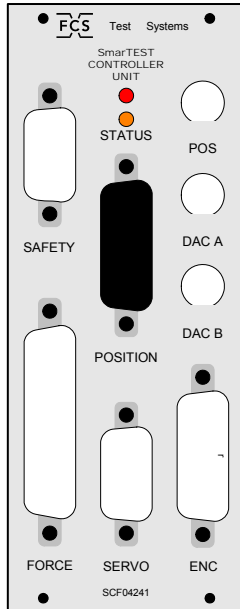
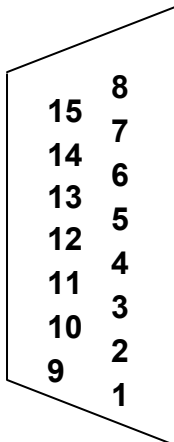


Table 3.8 SCU Position Connector (15-pins socket Sub-D)

Pin	Signal name	Description
1	LVDT_EXC1	LVDT Excitation High (10V _{peak} @ 3kHz)
2	LVDT_EXC2	LVDT Excitation Low
3	AGND	LVDT Coil reference
4	+VREFPOT	Potmeter excitation 5 V (max. 5 mA)
5	-VREFPOT	Potmeter excitation return -5 V (max. 5 mA)
6	+AD3	+ Test input (full range = ± 10 V)
7	-AD3	- Test input
8	AGND	Analog ground
9	LVDT_VA	LVDT in (software selectable), max. LVDT sensitivity is 0.9V/V
10	LVDT_VB	LVDT Signal Return
11	GND	Ground
12	VPOT	VPOT input (software selectable)
13	12VFUSED	12V power supply (0.5A)
14	1WDATA	μ -LAN
15	1WRET	μ -LAN Return

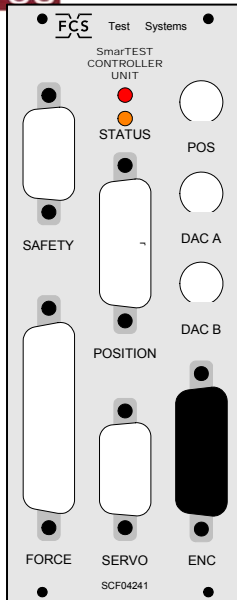


SCU position connector (15-pins Sub-D socket)

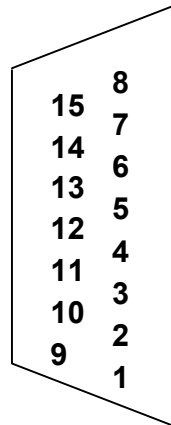
3.2.2.4 Encoder Connector

Table 3.9 SCU Position Connector (15-pins socket Sub-D)

Pin	Signal name	Description
1	ENCODERCLK	Encoder Clock
2	NENCODERCLK	Inv Encoder Clock
3	ENCODERINDEX	Encoder Index
4	NENCODERINDEX	Inv Encoder Index
5	5VFUSED	5V power supply (0.5A)
6	+AD3	+ Test input (full range = ± 10 V)
7	-AD3	- Test input
8	AGND	Analog ground



9	ENCODERDATA	Encoder Data
10	NENCODERDATA	Inv Encoder Data
11	GND	Ground
12	GND	Ground
13	12VFUSED	12V power supply (0.5A)
14	1WDATA	μ-LAN
15	1WRET	μ-LAN Return



encoder connector (15-pins Sub-D socket)

3.2.2.5 Force Connector

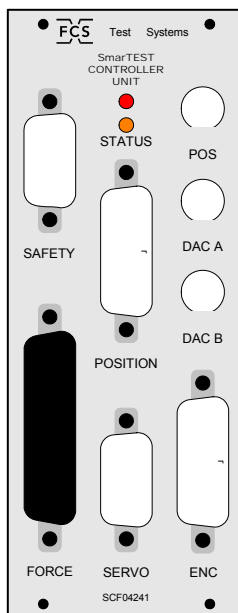
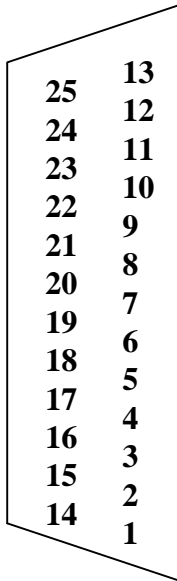


Table 3.10 SCU Force Connector (25-pins socket Sub-D)

Pin	Signal name	Description
1	+E0	Excitation ForceA 5 V(max 100 mA: min LC impedance 120 Ω)
2	-E0	Excitation Force A return -5 V (max. 100 mA)
3	+A0	+ Input Force A (H/W gain 1x, 125x, 250x, 500x)
4	-A0	- Input Force A
5	NC	Not Connected
6	+E1	Excitation ForceB 5V (max 100 mA: min LC impedance 120 Ω)
7	-E1	Excitation Force B return -5 V (max. 100 mA)
8	+A1	+ Input Force B (H/W gain 1x, 125x, 250x, 500x)
9	-A1	- Input Force B
10	ICP+	Charge Amplifier/Accelerometer Input
11	ICP-	Charge Amplifier/Accelerometer Return
12	12VFUSED	12V power supply (0.5A)
13	GND	Ground
14	+S0	Excitation sense Force A 5 V
15	-S0	Excitation sense Force A return -5 V
16	AGND	Shield LC Force A
17	NC	Not Connected
18	+S1	Excitation sense Force B 5 V
19	-S1	Excitation return Force B sense -5 V
20	AGND	Shield LC Force B
21	NC	Not Connected
22	NC	Not Connected
23	GND	Analog ground
24	1WDATA	μ-LAN
25	1WRET	μ-LAN Return

Please note that ICP® is only available on the piggyback of the SCU



SCU force connector (25-pins Sub-D socket)

See [Appendix F](#) for example of the actuator cable

3.2.2.6 BNC Connectors

The BNC connectors POS, DAC A and DAC B, provide a means of accessing the signals in the SmarTEST system in the analogue world. In the table below the pindefinition for the three BNC's are given.

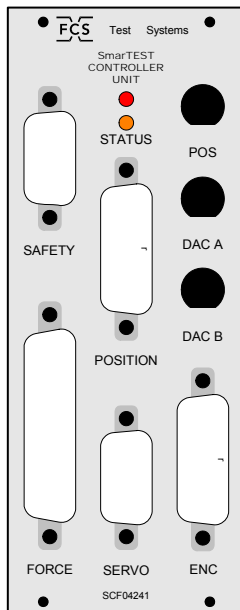


Table 3.11 SCU BNC POT connector signals

Pin	Signal name	Description
1	PLOT_POS	Actuator position 1 (full range = ± 10 V)
2	AGND	Analog Ground

Table.3.12 SCU BNC DAC A connector signals

Pin	Signal name	Description
1	+VDAC0	+ Selectable D/A converter A (full range = + 5 V)
2	AGND	Analog Ground

Table 3.13 SCU BNC DAC B connector signals

Pin	Signal name	Description
1	+VDAC2	+ Selectable D/A converter A (full range = + 5 V)
2	AGND	Analog Ground

3.2.3 SCF04244 SmarTEST Controller Front

The picture below is the SmarTEST Controller Front SCF04244 (formerly SCF04074). This SCF is used for the replacement of MTS 458 controllers. On this front the 50-pins ACTUATOR connector is divided in 4 separate connectors: Force, Position, Servo and Test in. Further there is a Shunt connector added in this front panel.

On this front the following connections are defined:

- (Safety (9 Pins Sub-D Socket)
- (Force (15 Pins Sub-D Socket)
- (Position (15 Pins Sub-D Socket)
- (Servo (15 Pins Sub-D Socket)
- (Test In (BNC Panel Socket)
- (Pos, DAC A and DAC B (BNC Panel Sockets)

On the following pages the pin definition of the SCF04244 front is described.



Figure 3.5 SmarTEST Controller Front SCF04244

3.2.3.1 Safety Connector

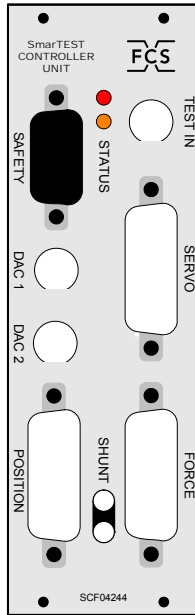
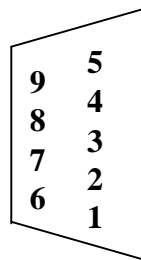


Table.3.14 SCU Safety Connector (9-pins socket Sub-D)

Pin	Signal name	Description
1	No_Ext_Fail_H	Supply input for No_External_Failure monitoring.
2	SCU_On_Req_H	Supply input for SCU_On_Request monitoring.
6	Ext_Pwr_On_H	Supply input for External_Power_On monitoring.
7	SCU_OK_H	Supply input for SCU_OK monitoring.
3	AGND	References external GND (from e.g SAH) to SCU GND.
4	Ext_Pwr_On_L	Output from SCU for External_Power_On monitoring.
5	SCU_OK_L	Output from SCU for SCU_OK monitoring.
8	No_Ext_Fail_L	Output from SCU for No_Ext_Fail monitoring.
9	SCU_On_Req_L	Output from SCU for SCU_On_Req monitoring.



SCU safety connector (9-pins Sub-D Socket).

3.2.3.2 Servo Valve Connector

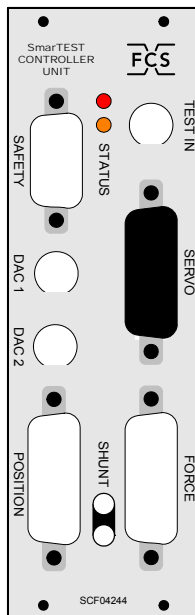
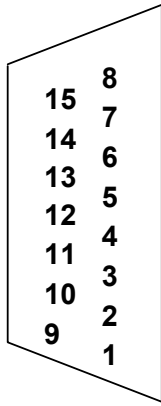


Table 3.15 SCU Servo Connector (15-pins socket Sub-D)

Pin	Signal name	Description
1	LVDT2_EXC1	LVDT2 Excitation High (10V _{peak} @ 3kHz)
2	LVDT2_EXC2	LVDT2 Excitation Low
3	AGND	LVDT2 Coil reference
4	LVDT2_VA	LVDT2 in (software selectable)
5	LVDT2_VB	LVDT2 Signal Return
6	ICP-	Charge Amplifier/Accelerometer Return
7	AGND	Analog ground
8	-VSERVO*	Voltage output Low (± 10 V)
9	+ISERVO	Current output High (max. ± 100 mA)
10	12VFUSED	12V power supply (0.5A)
11	-ISERVO	Current output Low (max. ± 100 mA)
12	5VFUSED	5V power supply (0.5A)
13	ICP+	Charge Amplifier/Accelerometer Input
14	GND	Ground
15	+VSERVO*	Voltage output High (± 10 V)

Please note that ICP[®] and LVDT2 is only available on the piggyback of the SCU



SCU servo connector (15-pins Sub-D socket)

NOTE * When the Vservo output of an SCU is used, the Iservo needs to be shorted (Iservo+ and Iservo- need to be connected).
If this is not performed, the Vservo output will be limited to ± 3.5 Volts, while it should be ± 10 Volt.

3.2.3.3 Position Connector

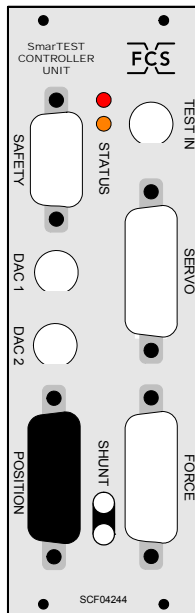
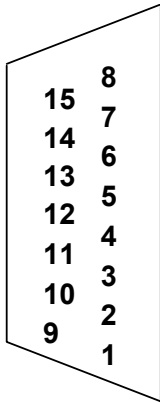


Table 3.16 SCU Position Connector (15-pins socket Sub-D)

Pin	Signal name	Description
1	LVDT_EXC1	LVDT Excitation High ($10V_{peak}$ @ 3kHz)
2	LVDT_EXC2	LVDT Excitation Low
3	AGND	LVDT Coil reference
4	LVDT_VA	LVDT in (software selectable), max. LVDT sensitivity is 0.9V/V
5	LVDT_VB	LVDT Signal Return
6	VPOT	VPOT input (software selectable)
7	AGND	Analog ground
8	+VREFPOT	Potmeter excitation 5 V (max. 5 mA)
9	ENCODERIND EX	Encoder Index
10	NENCODERIN DEX	Inv Encoder Index
11	ENCODERDAT A	Encoder Data
12	NENCODERDA TA	Inv Encoder Data
13	ENCODERCLK	Encoder Clock
14	NENCODERCL K	Inv Encoder Clock
15	-VREFPOT	Potmeter excitation return -5 V (max. 5 mA)



SCU position connector (15-pins Sub-D socket)

3.2.3.4 Force Connector

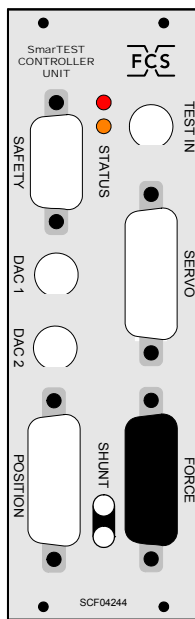
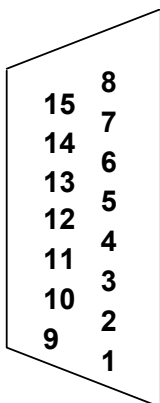


Table 3.17 SCU Force Connector (15-pins socket Sub-D)

Pin	Signal name	Description
1	+E0	Excitation Force A 5 V (max. 100 mA: min. LC impedance = 120 ohm)
2	-E0	Excitation Force A return -5 V (max. 100 mA)
3	AGND	Shield LC Force A
4	+A0	+ Input Force A (H/W gain 1x, 125x, 250x, 500x)
5	-A0	- Input Force A
6	-A1	- Input Force B
7	AGND	Shield LC Force B
8	-S1	Excitation return Force B sense -5 V
9	NC	Not Connected
10	+S0	Excitation sense Force A 5 V
11	+E1	Excitation Force B 5V (max. 100 mA: min. LC impedance = 120 ohm)
12	-E1	Excitation Force B return -5 V (max. 100 mA)
13	+A1	+ Input Force B (H/W gain 1x, 125x, 250x, 500x)
14	+S1	Excitation sense Force B 5 V
15	-S0	Excitation sense Force A return -5 V



SCU force connector (15-pins Sub-D socket).

NOTE

When using actuator cables without sense lines +Sx and -Sx, four jumpers must be installed on the header at the backside of the frontpanel. If these are left open the excitation signals will be adjusted automatically by the SCU, resulting in calibration problems (noisy signal)

See [Appendix F](#) for example of the actuator cable

3.2.3.5 BNC Connectors

The BNC connectors DAC 1, DAC 2 and Test In, provide a means of accessing the signals in the SmarTEST system in the analogue world. In the table below the pin definition for the three BNC's are given.

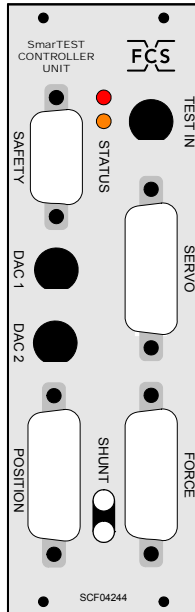


Table 3.18 SCU BNC DAC 1 connector signals

Pin	Signal name	Description
1	+VDAC0	+ Selectable D/A converter A (full range = + 5 V)
2	AGND	Analog Ground

Table 3.19 SCU BNC DAC 2 connector signals

Pin	Signal name	Description
1	+VDAC2	+ Selectable D/A converter A (full range = + 5 V)
2	AGND	Analog Ground

Table 3.20 SCU BNC Test In connector signals

Pin	Signal name	Description
1	+AD3	+ Test input (full range = +5 V)
2	AGND	Analog Ground

3.2.3.6 Shunt header

On this SCF04244 frontpanel a shunt header has been implemented to be able to connect a shunt resistor when needed. Switching on and off this external shunt resistor can be done via the SmarTEST software

The shunt header functionality is not available in software release v1.8.2. For further information contact Moog FCS customer support

3.2.4 SCF98050 SmarTEST Controller Front

The picture below is the SmarTEST Controller Front SCF98050, which is the most commonly used front panel.

On this front the following connections are defined:

- (Safety (9 Pins Sub-D Socket)
- (Actuator (50 Pins Sub-D Socket)
- (Maintenance (15 Pins Sub-D Socket)
- (DAC 1 & 2 (BNC Socket)

For EMC protection EMC filtered connectors are used and the front itself contains EMC springs. On the following pages the pin definition of the standard SCF98050 front is described.



Figure 3.6 SmarTEST Controller Front SCF98050

3.2.4.1 Safety Connector

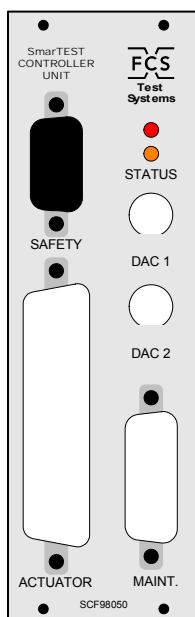


Table 3.21 SCU Safety Connector (9-pins socket)

Pin	Signal name	Description	External connections: chained to SAFETY of the previous SCU. External connection of the first SCU
1	NO_EXT_F AIL supply	Supply input side of external failure monitoring	28V via 4k7 resistor or a current source of 5mA (max. 48V).
2	ON_REQ supply	Supply input side of the on request optocouplers chain	28V via 4k7 resistor or a current source of 5mA (max. 48V).
3	A GND	References the SMB GND to the SCU GND.	Internally connected on SCF front
4	EXT_PWR_ ON out	Monitors external power. If the chain does not conduct, power fail message (pressure lost) and ON_REQ goes low.	switched to ground via the output of an external power_on switch / relay (e.g. pressure switch)
5	SCU_OK out	Output of the SCU_OK optocoupler chain. Used to enable external power to be on	via optocoupler input to GND.
6	EXT_PWR_ ON	Supply input side of external power monitoring	28V via 4k7 resistor or a current source of 5mA (max. 48V).
7	SCU_OK supply	Supply input side of the SCU_OK optocoupler chain	28V via 4k7 resistor or a current source of 5mA (max. 48V).
8	NO_EXT_F AIL out	Monitors external failures. If the chain does not conduct, external fail message (SMB fail) and ON_REQ goes low.	Switched to ground via the output of an external system_ok switch / relay (e.g. SMB OK relay).
9	ON_REQ out	Output of the ON_REQ optocoupler chain. Used to switch external power on.	via optocoupler input to GND.

3.2.4.2 Maintenance Connector

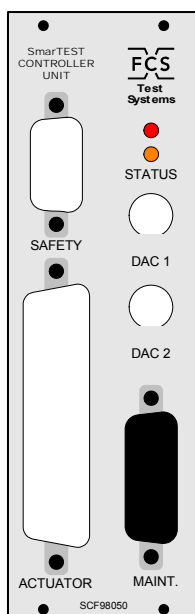


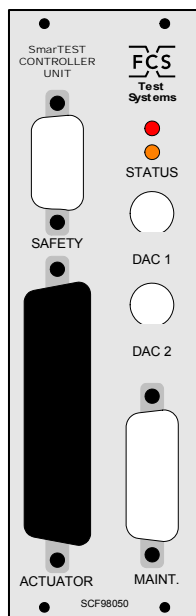
Table 3.22 SCU Maintenance Connector (15-pins socket)

Pin	Schematic Name	Signal name
4	PLOT_LC0	High-resolution 1 ($\pm 10V = \pm$ full range)
10	AGND	AGND (Analog GrouND)
3	PLOT_LC1	High-resolution 2 ($\pm 10V = \pm$ full range)
11	AGND	AGND
5	PLOT_POS	Actuator position 1 ($\pm 10V = \pm$ full range)
12	AGND	AGND
1	+AD3	+Test-input ($\pm 10V = \pm$ full range)
2	-AD3	- Test-input
9	AGND	AGND
6	+VDAC0	+ selectable D/A converter A ($\pm 5V = \pm$ full range)
7	-VDAC0	- selectable D/A converter A

13	AGND	AGND
15	+VDAC2	+ selectable D/A converter B ($\pm 5V = \pm$ full range)
8	-VDAC2	- selectable D/A converter B
14	AGND	AGND

3.2.4.3 Actuator Connector

Table 3.23 SCU Actuator Connector (50-pins socket)



Pin	Group	Schematic Name	Signal Name
36	Shields:	CGND	Connector Ground
20		AGND	Analog Ground
7	Force 1:	+E0	Excitation 5V (max. 100mA)
41		-E0	Excitation return -5 V (max. 100 mA)
24		+S0	Excitation sense 5 V
25		-S0	Excitation return sense -5 V
40		+A0	+ Input (HW.gain 1,125,250,500)
8		-A0	- Input
9		AGND	Analog ground Force 1
5	Force 2:	+E1	Excitation 5 V (max. 100 mA)
39		-E1	Excitation return -5 V (max. 100 mA)
22		+S1	Excitation sense 5 V
23		-S1	Excitation return sense -5 V
38		+A1	+ Input
6		-A1	- Input
37		AGND	Analog ground Force 2
34	Position 1:	LVDT_EXC1	LVDT Excitation High ($5V_{peak}$ @ 3kHz)
2		LVDT_EXC2	LVDT Excitation Low
3		AGND	LVDT Coil ref. (AGND)
19		LVDT_VA	LVDT in (also select jumper to LVDT)
11		VPOT	VPOT in (also select jumper to POT)
35		LVDT_VB	Signal-Return
43		+ VREPOT	Potmeter excitation 5 V (max. 5 mA)
28		- VREPOT	Potmeter excitation -5 V (max. 5 mA)
29	Test in:	+AD3	+ Test signal in
45		-AD3	- Test signal in
42		+ISERVO	Current output High (max. ± 100 mA)
27		+VSERVO*	Voltage output High (± 10 V)
26		-ISERVO1	Current output Return
10		-VSERVO*	Voltage output Low (± 10 V)
13	Digital in:	+OPTIN	Supply optocoupler diode
30		-OPTIN	return optocoupler diode

Pin	Group	Schematic Name	Signal Name
46	Digital out:	+OPTOUT	Collector optocoupler transistor
14		-OPTOUT	Emitter optocoupler transistor
15	Safety:	-BYPASS	ON_REQ out
32		-HOOFDKLEP	SCU_OK out
47		-DRUKSENSE	EXT_PWR_ON out
31		-ERRMAN	NO_EXT_FAIL out
21	U LAN	1WDATA	μ-LAN Force
4		GND	μ-LAN GND
18		1WDATA	μ-LAN Position
1		GND	μ-LAN GND
12		1WDATA	μ-LAN S/V
44		GND	μ-LAN GND

NOTE ** When the Vservo output of an SCU is used, the Iservo needs to be shorted (Iservo+ and Iservo- need to be connected).
If this is not performed, the Vservo output will be limited to ± 3.5Volts, while it should be ±10Volt.*

3.2.5 SCF00018 SmarTEST Controller Front

The picture below is the SmarTEST Controller Front SCF00018. On this front the 50-pins ACTUATOR connector is divided in 3 separate connectors: Force, Position and Servo.

On this front the following connections are defined:

- (Safety (9 Pins Sub-D Socket)
- (Force (25 Pins Sub-D Socket)
- (Position (15 Pins Sub-D Socket)
- (Servo (9 Pins Sub-D Socket)
- (Pos, DAC A and DAC B (4 mm Panel Sockets)

On the panel sockets a “panel socket to BNC” adapter can be connected for monitoring those specific signals on an oscilloscope.

Because this front is not a product that is normally kept on stock, sometimes, to decrease delivery times, the fronts are not equipped with EMC springs and filtered connectors. If EMC protection is definitely required, longer delivery times must be kept in mind. On the following pages the pin definition of the SCF00018 front is described.



Figure 3.7 SmarTEST Controller Front SCF00018

3.2.5.1 Safety Connector

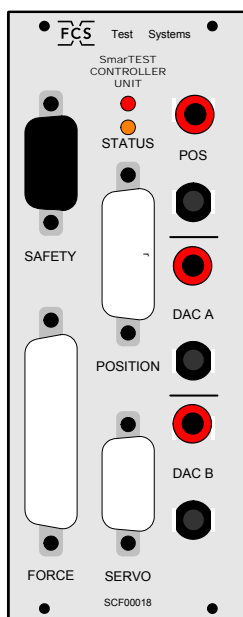


Table 3.24 SCU Safety Connector (9-pins socket Sub-D)

Pin	Signal name	Description	External connections: chained to SAFETY of the previous SCU. External connection of the first SCU
2	ON_REQ supply	Supply input side of the on request optocouplers chain	28V via 4k7 resistor or a current source of 5mA (max. 48V).
7	SCU_OK supply	Supply input side of the SCU_OK optocoupler chain	28V via 4k7 resistor or a current source of 5mA (max. 48V).
6	EXT_PWR_ON	Supply input side of external power monitoring	28V via 4k7 resistor or a current source of 5mA (max. 48V).
1	NO_EXT_F AIL supply	Supply input side of external failure monitoring	28V via 4k7 resistor or a current source of 5mA (max. 48V).
9	ON_REQ out	Output of the ON_REQ optocoupler chain. Used to switch external power on.	via optocoupler input to GND.
5	SCU_OK out	Output of the SCU_OK optocoupler chain. Used to enable external power to be on	via optocoupler input to GND.
4	EXT_PWR_ON out	Monitors external power. If the chain does not conduct, power fail message (pressure lost) and ON_REQ goes low.	switched to ground via the output of an external power_on switch / relay (e.g. pressure switch)
8	NO_EXT_F AIL out	Monitors external failures. If the chain does not conduct, external fail message (SMB fail) and ON_REQ goes low.	Switched to ground via the output of an external system_ok switch / relay (e.g. SMB OK relay).
3	A GND	References the SMB GND to the SCU GND.	Internally connected on SCF front

3.2.5.2 Servo Connector

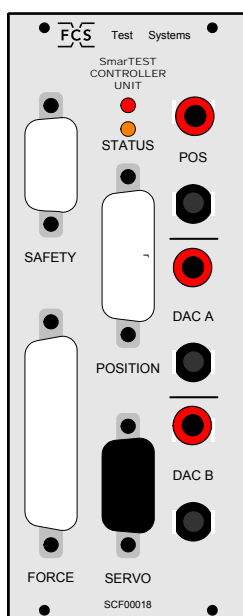


Table 3.25 SCU Servo Connector (9-pins socket Sub-D)

Pin	Schematic Name	Signal name
1	-ISERVO	Current output Return
2	+ISERVO	Current output High (max. $\pm 100\text{mA}$)
3	AGND	Shield (AGND)
4	NC	Not Connected
5	NC	Not Connected
6	-VSERVO*	Voltage output Low ($\pm 10\text{ V}$)
7	+VSERVO*	Voltage output High ($\pm 10\text{V}$)
8	1WDATA	μ -LAN Servo Valve
9	GND	μ -LAN GND

NOTE * When the Vservo output of an SCU is used, the Iservo needs to be shorted (Iservo+ and Iservo- need to be connected).
If this is not performed, the Vservo output will be limited to $\pm 3.5\text{Volts}$, while it should be $\pm 10\text{Volt}$.

3.2.5.3 Position Connector

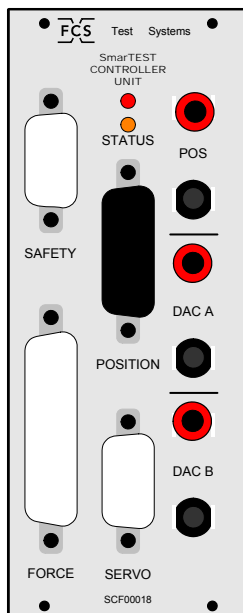


Table 3.26 SCU Position Connector (15-pins socket Sub-D)

Pin	Schematic Name	Signal name
1	LVDT_EXC1	LVDT Excitation High (5V _{peak} @ 3kHz)
2	LVDT_EXC2	LVDT Excitation Low
3	LVDT_REF	LVDT Coil ref. (AGND)
4	+ VREPOT	Potmeter excitation 5 V (max. 5 mA)
5	- VREPOT	Potmeter excitation -5 V (max. 5 mA)
6	+AD3	+ Signal in
7	-AD3	- Signal in
8	AGND	Analog GND
9	LVDT_VA	LVDT in (also select jumper to LVDT)
10	LVDT_VB	Signal-Return
11	AGND	Shield (AGND)
12	VPOT	VPOT in (also select jumper to POT)
13	NC	Not Connected
14	1WDATA	μ -LAN Position
15	GND	μ -LAN GND

3.2.5.4 Force Connector

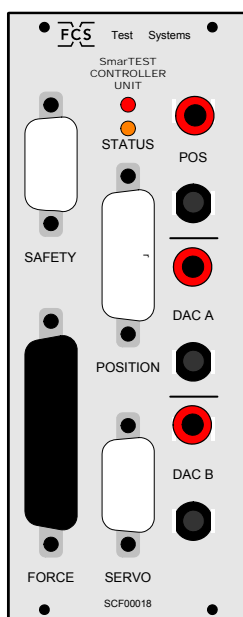


Table 3.27 SCU Force Connector (25-pins socket Sub-D)

Pin	Schematic Name	Signal name
1	+E0	Excitation 5 V Force A (max. 100 mA)
2	-E0	Excitation return -5 V Force A (max. 100 mA)
3	+A0	+ Input Force A (HW.gain 1,125,250,500)
4	-A0	- Input Force A
5	NC	Not Connected
6	+E1	Excitation 5 V Force B (max. 100 mA)
7	-E1	Excitation return -5 V Force B (max. 100 mA)
8	+A1	+ Input Force B
9	-A1	- Input Force B
10	NC	Not Connected
11	NC	Not Connected
12	NC	Not Connected
13	NC	Not Connected
14	+S0	Excitation sense 5 V Force A

Pin	Schematic Name	Signal name
15	-S0	Excitation return sense -5 V Force A
16	SHLDLC0	Shield LC force A
17	NC	Not Connected
18	+S1	Excitation sense 5 V Force B
19	-S1	Excitation return sense -5 V Force B
20	SHLDLC1	Shield LC force B
21	NC	Not Connected
22	NC	Not Connected
23	AGND	AGND
24	1WDATA	μ-LAN Force A and B
25	GND	μ-LAN GND

3.2.6 SCF04074 SmarTEST Controller Front

The picture below is the SmarTEST Controller Front SCF04074. This SCF front is used for the replacement of MTS 458 controllers. On this front the 50-pins ACTUATOR connector of the SCF98050 is divided in 4 separate connectors: Load, Position, Servo and Program in. Further there is a Shunt connector added in this front panel.

On this front the following connections are defined:

- (Safety (9 Pins Sub-D Socket)
- (Load (15 Pins Sub-D Socket)
- (Position (15 Pins Sub-D Socket)
- (Servo (15 Pins Sub-D Socket)
- (Program In (BNC Panel Socket)
- (DAC A and DAC B (BNC Panel Sockets)

This controller front was the predecessor of the SCF04244 and is therefore obsolete. Please contact your local SmarTEST X supplier in case you need additional support for this controller front. Further information on this controller front is not supported in this user manual.

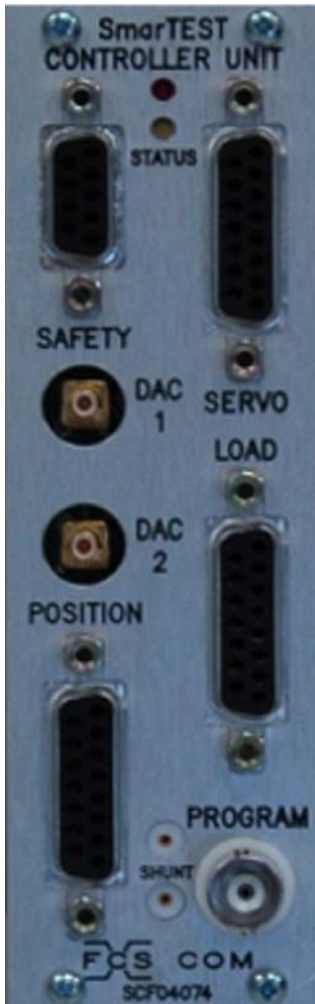


Figure 3.8 SmarTEST Controller Front SCF04074

3.2.7 SmarTEST Controller Unit Installation

Before installing the SCU the following jumper configuration and address switch settings must be checked and adjusted if necessary.

NOTE When using the SCU04200, the Potentiometer or LVDT setting can be switched via the software settings. On the SCU98049 a jumper must be configured correctly (see table below). Since the selection for POT or LVDT is being made using a multiplexer on the SCU04200, one should always short circuit either Vpot to AGND (when using LVDT) or Va & Vb to AGND (when using POT).

The SmarTEST ONE supports two types of SCU's:

- **SCU98049-40x** (403, 407, 408)
- **SCU04200-401**. This SCU can have more I/O by adding a piggyback (the SCU98049-421)

3.2.8 Jumper Settings SCU98049-40x

Table 3.28 SCU Jumper Settings

Selection	Jumper	Configuration
Pot	1	1-2 (default)
LVDT	1	2-3
100 mA Servo current	2	1-2 (default)
50 % Servo current	2	2-3
Pressure response	3	1-2 (always)

When SCU is installed
in SMC rack this side
is the top view →

When SCU is installed
in SMC rack this side
is the front view

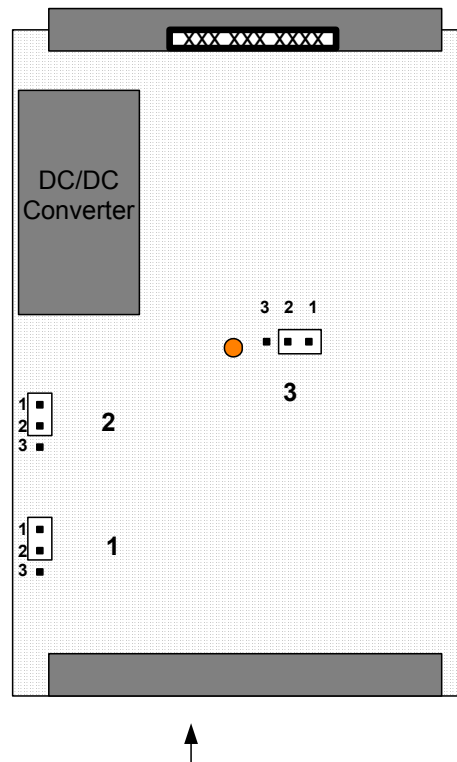


Figure 3.9 Jumper Configuration SCU98049-40x

3.2.9 SCU04200-401

The SCU controller cards can be installed in a rack with an AT96 backplane. Here is a schematical layout of the SCU.

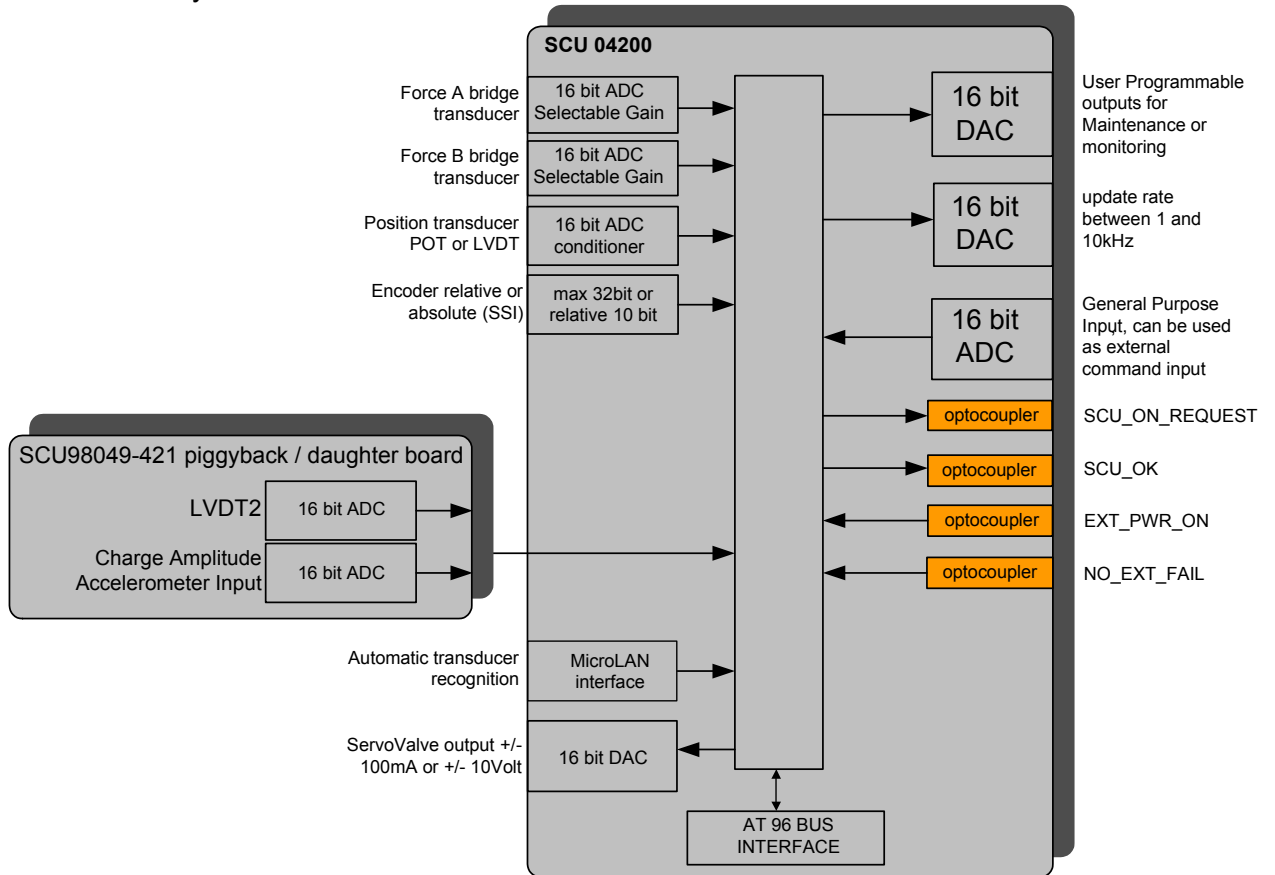


Figure 3.10 Schematical layout of the SCU04200-401.

A picture of the printed board of a SCU04200-401 is given below:



Figure 3-11 Physical appearance of the SCU04200-401

3.2.10 SCU98049-421 daughter board

Below a picture can be found of an SCU98049-421 daughter board (for LVDT2 and Accelerometer inputs), mounted on a SCU04200-401

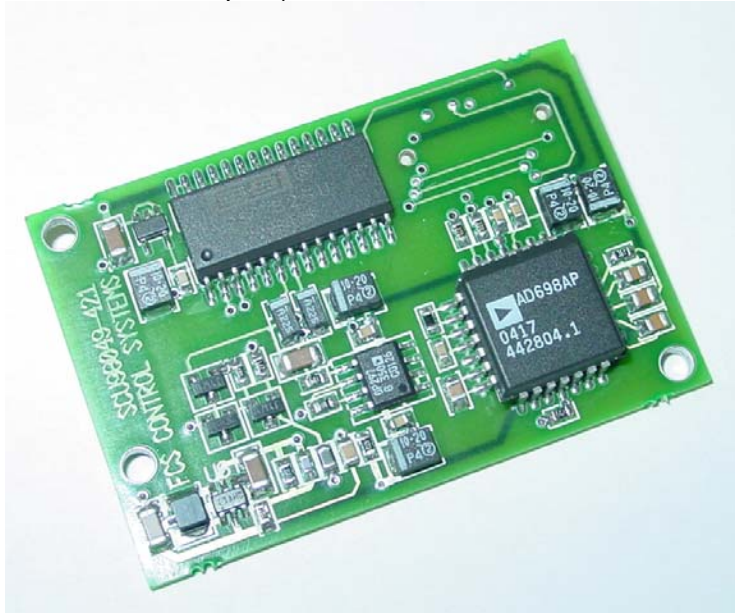


Figure 3-12 Physical appearance of the SCU98049-421 piggyback

A daughter board (piggy back) can be installed on the SCU to extend the number of inputs. To use the LVDT2 and accelerometer inputs you must have one of the following SmarTEST controller frontpanels (SCF).

SCF partnumber	Connector	Signal name
SCF04064	Auxiliary connector	LVDT2
	Auxiliary connector	ICP®
SCF04241	Servo Valve connector	LVDT2
	Force Connector	ICP®
SCF04244	Servo connector	LVDT2
	Servo connector	ICP®

The pin description of these signals can be found in the SmarTEST Controller front description.

Technical specifications:

ICP® input

- High Frequency Response max. 3 kHz
- Sampling rate 100kHz, downconverted to suit SmartestOne sampling rate
- Resolution 16bit
- Low Frequency Response, AC coupled (-5 %) 0.5 Hz
- Voltage Gain (Incremental Steps) x1, x10, x100
- Broadband Electrical Noise (1 Hz to 10 kHz) 20 μ V rms
- Discharge Time Constant (AC coupled) 1 sec

LVDT input

- (0.003%) with LVDT excitation (5V peak to peak @ 10kHz)

Parameter	Value
ACC	ICP®

ICP® is a registered trademark of PCB Group, inc., Depew, New York

3.2.11 Address switch

Each SCU has a unique number in the SmarTEST ONE system. This number is NOT related to the slot number the controller is inserted in. FCS advises to use increasing numbers for the controllers from RIGHT TO LEFT. The one next to the processor module is number 0, the one left of it number 1 etc. If a new controller has been added, set the controller number to the next available number. If a controller has been replaced, the number has to be identical to the one which was removed. The number can be set with a small screwdriver on the PCB turn switch.

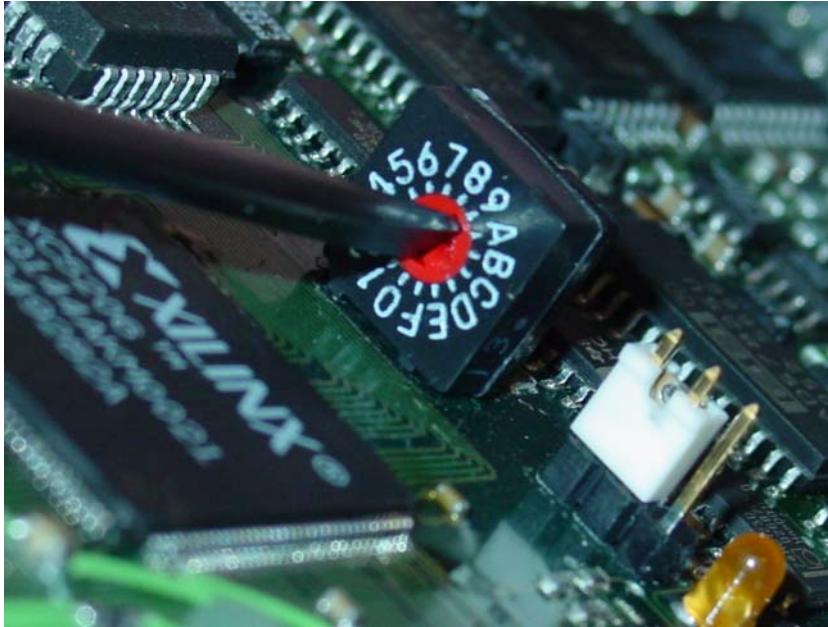


Figure 3.13 Address-switch

3.2.12 Physical Installation

3.2.12.1 New SCU

To install a new SCU; perform the actions as described below:

- (First make sure that the power of the SmarTEST ONE is off (switch at the backside of the unit). Remove the power cable.
- (Make also sure that you are connected to an ESD safe GND, so no ESD voltages will affect the hardware.

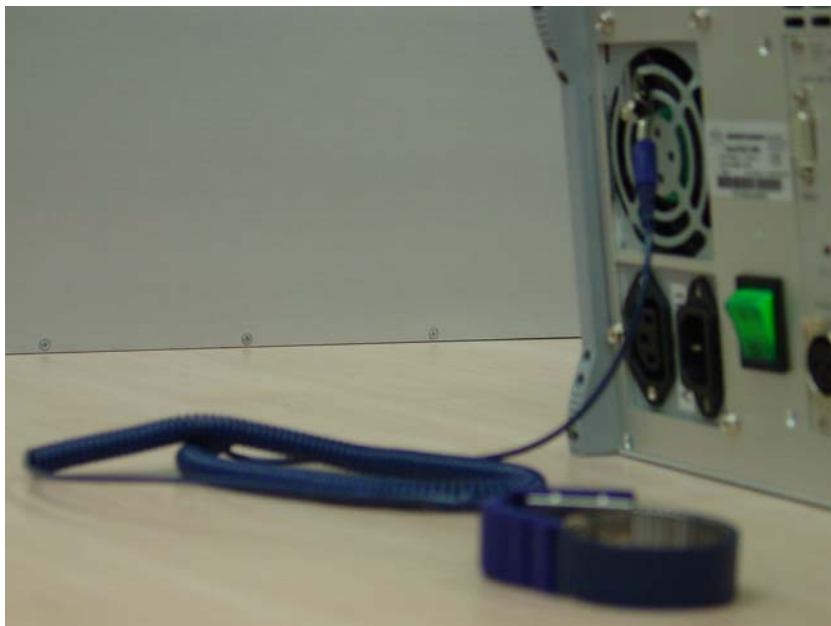


Figure 3.14 ESD Safety connection

- (
- Decide in which slot to install the new SCU and unscrew panels like described below:
 - If slot 1 (most left) is free, you have to unscrew the fronts of slot 1 and 2.
 - If slot 2 for example is free, you have to unscrew the fronts of slot 2 and 3.

NOTE If the transportation locking bar is still in place (default), all front panels have to be removed.



Figure 3.15 Remove the blank filler plates

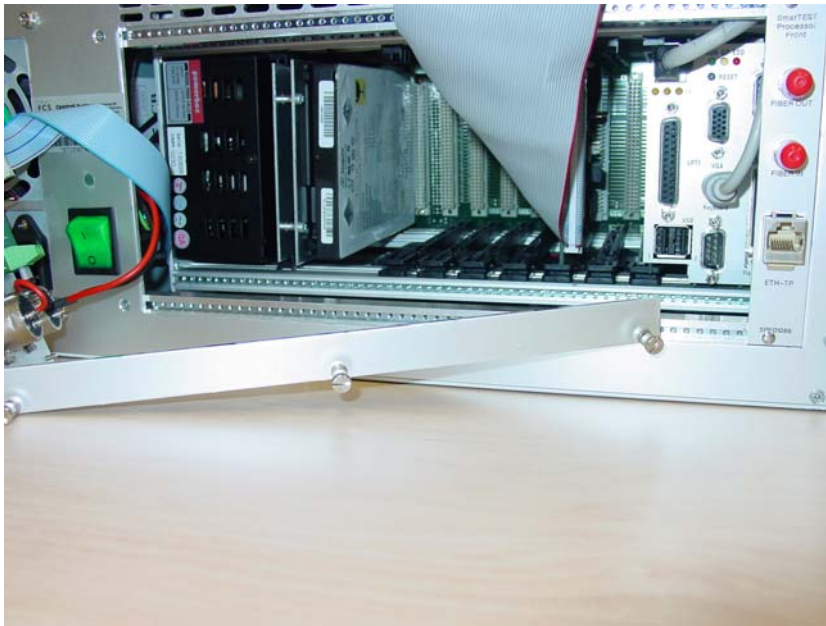


Figure 3.16 Remove the locking bar

- (Check all settings of SCU (jumpers and address switch) and put the new card in the corresponding slot.
- (Connect the flat cable to the new SCU
- (If the SmarTEST ONE unit will be transported, always replace the locking bar. If this bar will not be replaced, the cards can become loose from their slots if the SmarTEST ONE unit is exposed to shocks.

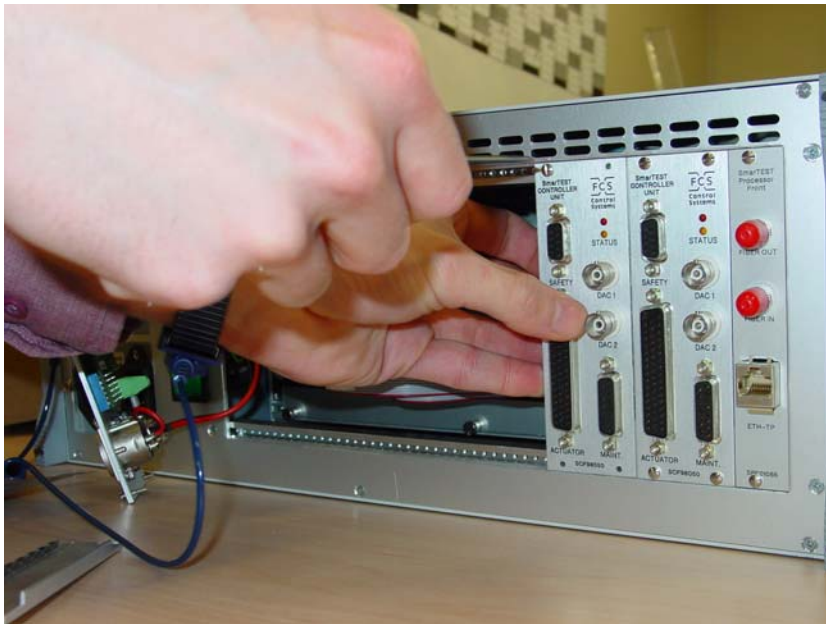


Figure 3.17 Place the SCU and blank fronts

- (Replace all front panels.
- (Power up the Controller.

Replace existing SCU

To exchange the SCU's; perform the actions as described below:

- (First make sure that the power of the SmarTEST ONE is off (switch at the backside of the unit). Remove the power cable.

- (Make also sure that you are connected to an ESD safe GND, so no ESD voltages will affect the hardware.

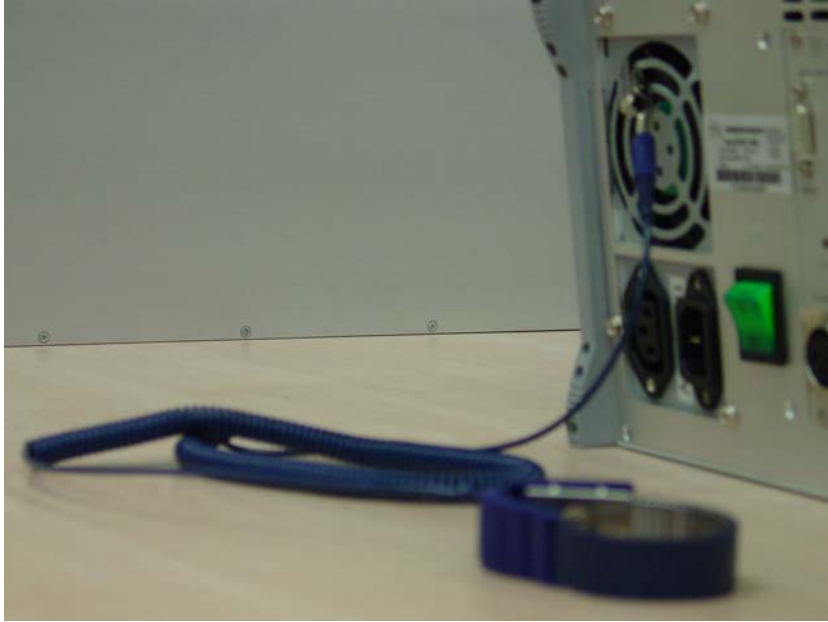


Figure 3.18 Connect a ground cable for safety

- (Determine which number of the card has failed and unscrew panels like described below :
 - If SCU 1 (most right SCU when looked from the backside) has failed, unscrew the fronts of SCU 1 and 2.
 - If SCU 2 for example has failed, unscrew SCU Front 2 and 3.

NOTE If the transportation locking bar is still in place (default), all front panels have to be removed.



Figure 3.19 Remove the blank filler plates

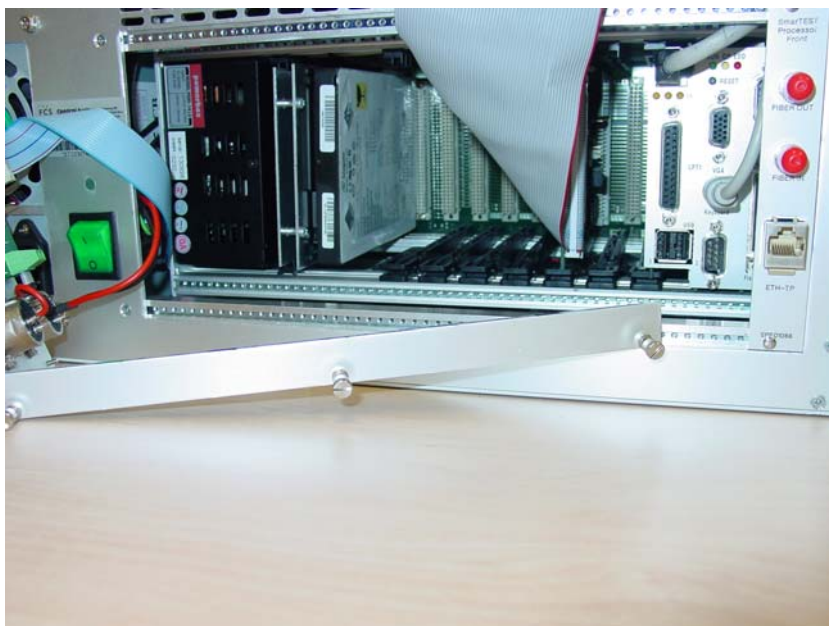


Figure 3.20 Remove the locking bar

- (Disconnect the flat cable from the SCU side and pull down the eject handle at the bottom of the card. Pull out the SCU, write down S/N, and address switch setting (1-4).
- (Check all settings from the old SCU with the new one (jumpers and address switch) and put the new card in the corresponding slot.
- (Connect the flat cable to the new SCU
- (If the SmarTEST ONE unit will be transported, always replace the locking bar. If this bar will not be replaced, the cards can become loose from their slots if the SmarTEST ONE unit is exposed to shocks.
- (Replace all front panels.
- (Power up the controller.

4 Manifold Control Unit



In addition to the standard hydraulic switching capabilities on the SAH panel as described in [chapter 2](#), the SmarTEST X can also be used in combination with a Manifold Control Unit (MCU). This device allows the operator to switch each valve “on / off – low / high pressure” per actuator. This can be done manually per station via the MCU front panel or automatically via the digital I/O’s in the SmarTEST X or via the F-net connection depending of the type of MCU.

The MCU is default equipped with 4 manifold channels. It has a compact housing being only half the height of the SmarTEST ONE.

Each valve is rated at maximum 24VDC/2A and this can easily be modified to switch 115VAC/1A.

The safety link is compatible with the controller boards (SCU’s) inside the SmarTEST X.

The emergency button of the SmarTEST X shuts down all 4 channels.

There are two versions of the MCU:

- Digital I/O board connected MCU (partnumber STO 03067)
- F-NET connected MCU (partnumber STO 03067-201)

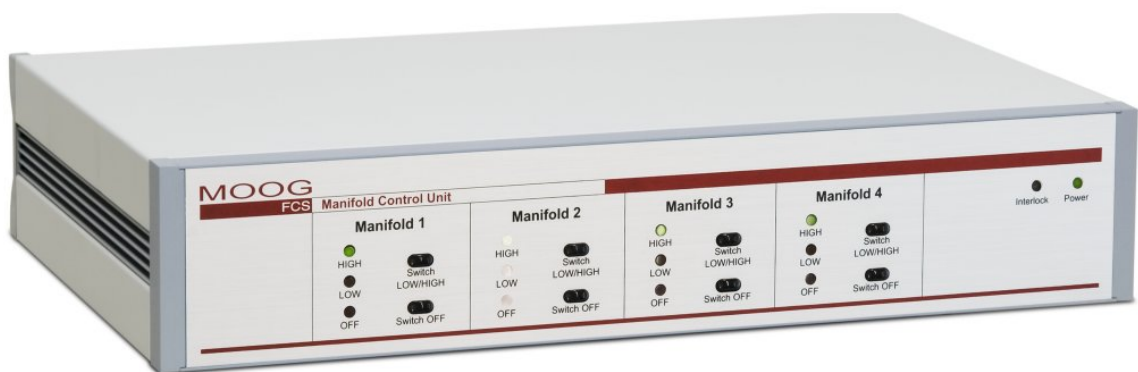


Figure 4.1 MCU front panel

4.1 MCU connected via Digital I/O Board

Figure 4.2 MCU (STO3067) back panel

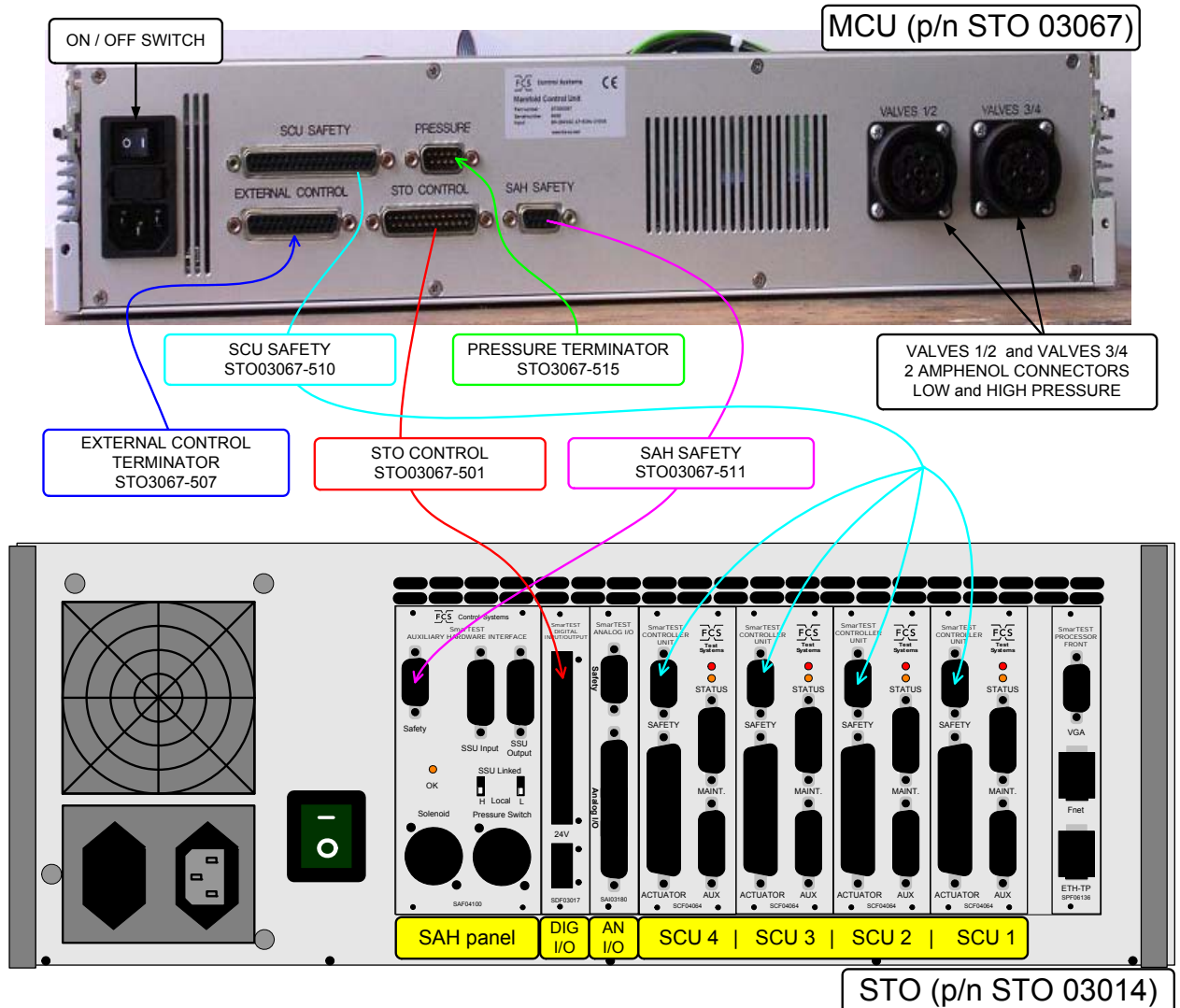


Figure 4.3 MCU (STO3067) connections to STO back panel

4.1.1 Connectors of the MCU

Summary of MCU Connector cables and terminator's:

MCU Connector	Partnumber	Description
SCU SAFETY	STO3067-510	37-pins SCU Safety cable for 4 SCU's
	STO3067-513	37-pins SCU Safety cable for 2 SCU's
PRESSURE	STO3067-515	9-pins pressure terminator connector
EXTERNAL CONTROL	STO3067-507	25-pins external control terminator connector
STO CONTROL	STO3067-501	25-pins STO Controller cable to Digital I/O board
	STO3067-508	25-pins terminator connector for manual control
SAH SAFETY	STO3067-511	9-pins SAH safety cable

4.1.1.1 SCU Safety Connector

Table 4.1 SCU Safety Connector (37-pins sub-D female)

Pin	Signal Name	Description
1	SCU_OK_H	SCU 1 Output for SCU_OK monitoring
2	SCU_ON_H	SCU 1 Output for SCU_On_Request
3	NO_EXT_FAIL_H	SCU 1 Output for No_External_Failure
4	EXT_POWER_ON_H	SCU 1 Output for External_Power_On monitoring
5	GND	ground
6	SCU_OK_H	SCU 2 Output for SCU_OK monitoring
7	SCU_ON_H	SCU 2 Output for SCU_On_Request
8	NO_EXT_FAIL_H	SCU 2 Output for No_External_Failure
9	EXT_POWER_ON_H	SCU 2 Output for External_Power_On monitoring
10	SCU_OK_H	SCU 3 Output for SCU_OK monitoring
11	SCU_ON_H	SCU 3 Output for SCU_On_Request
12	NO_EXT_FAIL_H	SCU 3 Output for No_External_Failure
13	EXT_POWER_ON_H	SCU 3 Output for External_Power_On monitoring
14	GND	ground
15	SCU_OK_H	SCU 4 Output for SCU_OK monitoring
16	SCU_ON_H	SCU 4 Output for SCU_On_Request
17	NO_EXT_FAIL_H	SCU 4 Output for No_External_Failure
18	EXT_POWER_ON_H	SCU 4 Output for External_Power_On monitoring
19	NC	<i>not connected</i>
20	SCU_OK_L	SCU 1 Input from SCU for SCU_OK monitoring
21	SCU_ON_L	SCU 1 Input from SCU for SCU_On_Req monitoring
22	NO_EXT_FAIL_L	SCU 1 Input from SCU for No_Ext_Fail monitoring
23	EXT_POWER_ON_L	SCU 1 Input from SCU for External_Power_On monitoring
24	SCU_OK_L	SCU 2 Input from SCU for SCU_OK monitoring
25	SCU_ON_L	SCU 2 Input from SCU for SCU_On_Req monitoring
26	NO_EXT_FAIL_L	SCU 2 Input from SCU for No_Ext_Fail monitoring
27	EXT_POWER_ON_L	SCU 2 Input from SCU for External_Power_On monitoring
28	GND	ground
29	SCU_OK_L	SCU 3 Input from SCU for SCU_OK monitoring
30	SCU_ON_L	SCU 3 Input from SCU for SCU_On_Req monitoring
31	NO_EXT_FAIL_L	SCU 3 Input from SCU for No_Ext_Fail monitoring
32	EXT_POWER_ON_L	SCU 3 Input from SCU for External_Power_On monitoring
33	SCU_OK_H	SCU 4 Input from SCU for SCU_OK monitoring
34	SCU_ON_H	SCU 4 Input from SCU for SCU_On_Req monitoring

Pin	Signal Name	Description
35	NO_EXT_FAIL_H	SCU 4 Input from SCU for No_Ext_Fail monitoring
36	EXT_POWER_ON_H	SCU 4 Input from SCU for External_Power_On monitoring
37	GND	ground

4.1.1.2 Pressure Switch Connector

Table 4.2 Pressure switch Connector (9-pins sub-D male)

Pin	Signal Name	Description
1	Ext_Power_ON_1	Pressure switch SCU 1
2	Ext_Power_ON_2	Pressure switch SCU 2
3	GND	Ground
4	Ext_Power_ON_3	Pressure switch SCU 3
5	Ext_Power_ON_4	Pressure switch SCU 4
6	GND	Pressure switch return SCU 1
7	GND	Pressure switch return SCU 2
8	GND	Pressure switch return SCU 3
9	GND	Pressure switch return SCU 4

NOTE In case the pressure switch will not be used, make sure that the supplied pressure terminator (STO3067-515) is connected.

4.1.1.3 External Control Connector

Instead of using the hardware buttons on the front, the MCU can also be controlled by an external remote switch box. By doing this the External Control specification described below should be used.

NOTE In case an external box will not be used, make sure that the supplied terminator connector (STO3067-507) is connected.

Table 4.3 External Control (25-pins sub-D female)

Pin	Signal Name	Description
1	KEY_OFF_1	Off Key 1
2	KEY_HI_LO_1	High-Low Key 1
3	KEY_OFF_3	Off Key 3
4	KEY_HI_LO_3	High-Low Key 3
5	24V	Fused to 1A)
6	24V	Fused to 1A)
7	NC	Not Connected
8	EXT_LED_HI_1	High LED 1
9	EXT_LED_LO_1	Low LED 1

Pin	Signal Name	Description
10	EXT_LED_OFF_1	Off LED 1
11	EXT_LED_HI_3	High LED 3
12	EXT_LED_LO_3	Low LED 3
13	EXT_LED_OFF_3	Off LED 3
14	KEY_OFF_2	Off Key 2
15	KEY_HIGH_LO_2	High-low key 2
16	KEY_OFF_4	Off Key 4
17	KEY_HIGH_LO_4	High-Low Key 4
18	GND	Ground
19	GND	Ground
20	EXT_LED_HI_2	High LED 2
21	EXT_LED_LO_2	Low LED 2
22	EXT_LED_OFF_2	Off LED 2
23	EXT_LED_HI_4	High LED 4
24	EXT_LED_LO_4	Low LED 4
25	EXT_LED_OFF_4	Off LED 4

4.1.1.4 STO Control Connector to Digital I/O

The supplied digital I/O cable (STO3067-501) should be connected to STO control connector and the digital I/O board of the SmarTEST X.

NOTE

In order to have the MCU recognized and functioning properly, it is necessary to set the related digital I/O board on address "F". Software builds later than version 1.6.4 build274 support multiple MCU's. That means one Digital I/O board for each MCU is needed. This is not needed for a single SmarTEST ONE, but for X2 systems (2 STO's) when more than 4 manifolds are used. For more information about multiple MCU usage we ask you to contact Customer Support.

When only operating in manual control the digital I/O board will not be used, make sure that the supplied 25 pins female terminator connector (STO3067-508) has been connected.

Table 4.4 STO Control (25-pinsSub-D male)

Pin	Signal Name	Description
1	DIGIN0	Digital Input 0
2	DIGIN1	Digital Input 1
3	DIGIN2	Digital Input 2
4	DIGIN3	Digital Input 3
5	DIGIN4	Digital Input 4
6	DIGIN5	Digital Input 5
7	DIGIN6	Digital Input 6
8	DIGIN7	Digital Input 7

Pin	Signal Name	Description
9	NC	Not Connected
10	NC	Not Connected
11	NC	Not Connected
12	24V	Fused to 1A
13	24V	Fused to 1A
14	DIGOUT0	Digital Output 0
15	DIGOUT1	Digital Output 1
16	DIGOUT2	Digital Output 2
17	DIGOUT3	Digital Output 3
18	DIGOUT4	Digital Output 4
19	DIGOUT5	Digital Output 5
20	DIGOUT6	Digital Output 6
21	DIGOUT7	Digital Output 7
22	NC	Not Connected
23	RSV	Reserved
24	GND	Ground
25	GND	Ground

4.1.1.5 SAH Safety Connector

Table. 4.5 SAH Safety Connector (9 pins sub-D female)

Pin	Signal Name	Description
1	No_Ext_Fail_L	No_External_Failure (Low)
2	On_Request_L	On Request (Low)
3	GND	Ground
4	Ext_Power_On_H	External Power On (High)
5	SCU_OK_H	SCU OK (High)
6	Ext_Power_On_L	External Power On (Low)
7	SCU_OK_L	SCU OK (Low)
8	No_Ext_Fail_H	No_External_Failure (High)
9	On_Request_H	On Request (High)

For a description of these Safety signals [see chapter SAH Safety](#)

4.1.1.6 High/Low pressure Amphenol Connectors

The MCU is supplied with two amphenol connectors (two plastic round connectors), in order to prepare the cables for the low and high pressure solenoids.

Table 4.6 Valves 1&2 (Amphenol C16-3 8+1)

Pin	Signal Name	Description
1	SOL_HI1	High Valve 1
2	SOL_HI1_RETURN	Return High Valve 1
3	SOL_HI2	High Valve 2
4	SOL_HI2_RETURN	Return High Valve 2
5	SOL_LO1	Low Valve 1
6	SOL_LO1_RETURN	Return Low Valve 1
7	SOL_LO2	Low Valve 2
8	SOL_LO2_RETURN	Return Low Valve 2
PE	PE	Protective Earth

Table 4.7 Valves 3&4 (Amphenol C16-3 8+1)

Pin	Signal Name	Description
1	SOL_HI3	High Valve 3
2	SOL_HI3_RETURN	Return High Valve 3
3	SOL_HI4	High Valve 4
4	SOL_HI4_RETURN	Return High Valve 4
5	SOL_LO3	Low Valve 3
6	SOL_LO3_RETURN	Return Low Valve 3
7	SOL_LO4	Low Valve 4
8	SOL_LO4_RETURN	Return Low Valve 4
PE	PE	Protective Earth

4.1.2 MCU 2 Channels to 1 Station Adapter Cable

The standard SCU SAFETY cable (STO3067-510 - 37pins for 4 SCU's) connects the SCU safety connector of the MCU with the 4 safety connectors on the SCU's. It will then be possible to have each channel coupled to each manifold. If it is needed to have 2 channels connected to one manifold then the adapter safety cable STO3067-520 is needed.

4.2 F-NET MCU

The difference between the F-NET MCU (partnummer STO 03067-201) and the Digital IO MCU is that the F-NET MCU does not need a digital I/O board in the SmarTEST X or STO for controlling the MCU. Instead the STO Control to the F-NET MCU is done through the F-NET connection of the F-NET MCU. That is why you do not find the 25-pins STO control connector at the back of F-NET MCU. The other F-NET connection can be used to connect a second F-NET MCU. The F-NET MCU has 4 separate valve (XLR) connectors, one for every manifold to switch low and high pressure. The other 4 sub-D connectors (SAH Safety, SCU Safety, Pressure and External Control) are exactly the same as on the Digital I/O MCU. For the pin description of these connectors see the paragraph above in the Digital I/O connected MCU.

NOTE In case an external box will not be used, make sure that the supplied terminator connector (STO3067-507) is connected.
In case the pressure switch will not be used, make sure that the supplied pressure terminator (STO3067-515) is connected.

The frontpanel of this F-NET MCU is the same as the Digital IO MCU.
The backside of the F-NET MCU (STO 03067-201) has Emergency STOP and Emergency RESET connections to connect to Emergency STOP and RESET buttons on the front of the SmarTEST X cabinet.

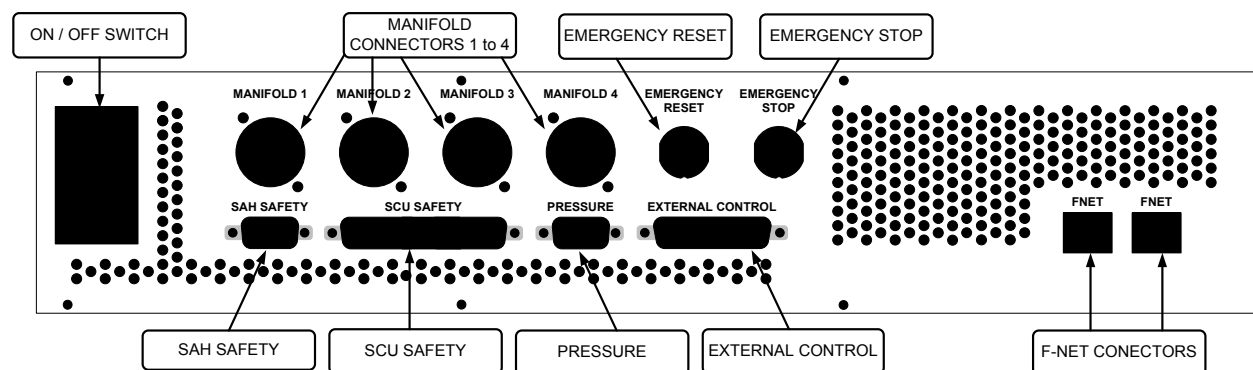


Figure 4.4 F-NET connected MCU (STO03067-201) back panel

4.2.1 Manifold Connector for Low/high Pressure

Table 4.8 Manifold Connector (5 pins XLR connector)

Pin	Signal Name	Description
1	LOW	Low Pressure VALVE Supply +24V (Fused 2A each)
2	LOW R	Low Pressure Return, VALVE Supply GND
3	HIGH	High Pressure VALVE Supply +24V (Fused 2A each)
4	HIGH R	High Pressure Return, VALVE Supply GND
5	NC	Not connected

For the pin description of the other connectors (SAH Safety, SCU Safety, Pressure and External Control) see the paragraph Digital I/O connected MCU.

4.2.2 Emergency Reset connector

Table 4.9 Emergency Reset Connector (3 pins female socket)

Pin	Signal Name	Description
1	A1	Manual reset power (+ 24 V DC Supply Voltage)
2	S34	Manual reset input
3	N.C. contact	Normally Closed – Reset Status

Connect pin1 to pin 3 via 24V LAMP

4.2.3 Emergency Stop connector

Table 4.10 Emergency Stop Connector (5 pins female socket)

Pin	Signal Name	Description
1	S12	E STOP 1 - 2
2	S22	E STOP 2 - 2
3	S21	E STOP 2 - 1
4	S11	E STOP 1 - 1
5	NC	Not connected

5 Remote Control (not implemented in software v1.8.2)

The remote (inching pendant) unit is an optional external hardware addition used to provide the customer with the ability to move an actuator (in position control) in a controlled manner from a remote position (usually close to the machine). Up to four inching pendants can be connected to any one controller. One digital I/O board is required for every two handhelds. The digital address must be set to "D" or "E" if one or two inching pendants are used on one digital I/O board. The digital addresses must be set to "D" and "E" if the inching pendants are used in combination with 2 digital I/O boards. These boards must be configured for 8 inputs and 8 outputs.

The E-stop generates a failsafe, just like pushing the emergency stop on the frontpanel of the STO.



5.1 Remote Control Digital I/O Connector

Table 5.1 Female connector (16-pins and 2-pins socket)

Pin	Signal Name	Description
1	ACTIVATE	Activate Pendant Unit
2	Channel Up	Up
3	Channel Down	Down
4	Channel Speed	Speed
9	Mode Channel Out	Digital Output #1
24V	24 Volts	+24VDC
GND	GROUND	Gnd

For the cabling diagram of the Remote inching pendant see [Appendix E](#)

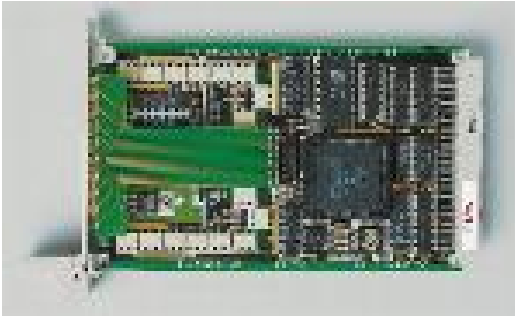
NOTE *In order to have the remote control recognized and functioning properly, it is necessary to set the related digital I/O board on address to "D" or "E".*

Check if the Pendant is recognized by the software after you startup the STO. You must see the message "One pendant board detected" in the message pane (if you use one pendant). Before using the remote inching pendant read the complete description of the Remote control operation in the SmarTEST ONE User Manual. This is because the values in the remote inching pendant setup screen must be set correctly before the Pendant unit will work.

6 Digital Input/Output Module

The ISA96/AT96 DIGIO has up to 8 inputs and 8 outputs potentially separated via optocoupler. The digital outputs are able to switch a load of 500mA against 0V or against +24V and are secured against overload and overtemperature.

NOTE The digital I/O module requires an external supply voltage of +24 V. This supply voltage must be applied to the 24V pin on the 2 pins socket (24V and GND connections) of the digital I/O connector front **SDF03017**. Also connect the GND pin of this 2 pin socket to ground. See figure 6.1



One or two digital I/O modules can be placed in the SmarTEST ONE in combination with (up to 4) pendant units. Also for the use of the MCU a digital I/O module is required (not needed for the FNET MCU). One extra digital I/O module can be placed in the 4 channel SmarTEST ONE for additional use. The SmarTEST Xx systems are not limited by the amount of digital I/O modules that can be used.

When more digital I/O cards are connected for external use set the rotary switch of the first digital I/O card to "0" and set the address of the second digital I/O card to "1"(only for SmarTEST Xx)

Check if the digital I/O board is recognized by the software after you startup the STO. You must see the message "Digital I/O card detected 8 inputs, 8 outputs." in the message pane (only the digital I/O module for external use)

The rotary switch on the digital I/O board must be adjusted depending on the hardware unit that is connected to the digital I/O module (only for software version earlier than v1.6.4build274).

For the remote control (pendant unit) it is necessary to set the rotary switch on the related digital I/O board on address "D" (for remote control 1 and 2) or "E" (for remote control 3 and 4).

For the MCU set the rotary switch on the related digital I/O board on address "F"

SmarTEST Xx systems with software builds later than v1.6.4build274 support multiple MCU's. That means one digital I/O board for each MCU is needed. This is not needed for STO's, but for SmarTEST X2 systems where more than 4 manifolds are used. As of this software build (v1.6.4build274) the digital I/O boards do not depend on address settings anymore (except for Pendant unit). For more information about multiple MCU usage contact Customer Support.

The technical data of the digital inputs and outputs in detail:

Table 6.1 Digital IO Limit Data

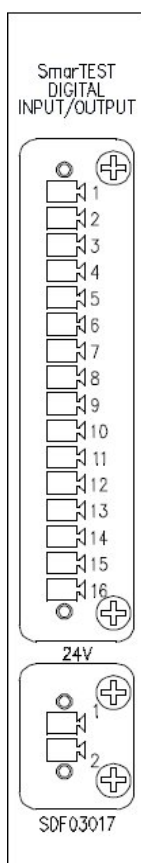
Parameter	Name	Min.	Type	Max.	Unit
Max. Input voltage	U _{max}	-5	-	50	V
Max. Input voltage (50%)	U _{ss}	-	-	100	V
Max. Input voltage (10µs)	U _{ss1}	-	-	1000	V
Max. supply voltage	U _{max}	-	-	40	V
Max. peak Output current (once)	I _{max}	-3	-	3	A
Max. peak Output current (steady)	I _{max}	-0.5	-	0.5	A
Limit temperature	T _{max}	-	150	-	°C

Table 6.2 Digital IO Operation Data

Parameter	Name	Min.	Type	Max.	Unit
Nominal Input voltage	U_{nom}	-	24	-	V
Nominal Input current	I_{nom}	1.1	1.25	1.3	mA
Nominal Input resistance (24V)	R_{nom}	9.5	10	10.5	k Ω
Input voltage for logical high	U_{high}	14	24	50	V
Input voltage for logical low	U_{low}	-5	0	10	V
Time constant (0V \rightarrow 24V)	t _{glh}	-	5	-	μ s
Time constant (24V \rightarrow 0V)	t _{ghl}	-	90	-	μ s
Nominal supply voltage	U_{nom}	-	24	-	V
Nominal steady Output current	I_{nom}	-0.5	-	0.5	A
Switch-on resistance	R_{son}^d	-	1.2	-	Ω
Saturation voltage	U_{sat}	-	0.6	-	V

6.1 Digital I/O connector SDF03017

Table 6.3 Female connector 16-pins and 2-pins power supply socket



Pin	Signal Name	Description
1	DIGIN1	Digital Input 1
2	DIGIN2	Digital Input 2
3	DIGIN3	Digital Input 3
4	DIGIN4	Digital Input 4
5	DIGIN5	Digital Input 5
6	DIGIN6	Digital Input 6
7	DIGIN7	Digital Input 7
8	DIGIN8	Digital Input 8
9	DIGOUT1	Digital Output 1
10	DIGOUT2	Digital Output 2
11	DIGOUT3	Digital Output 3
12	DIGOUT4	Digital Output 4
13	DIGOUT5	Digital Output 5
14	DIGOUT6	Digital Output 6
15	DIGOUT7	Digital Output 7
16	DIGOUT8	Digital Output 8
24V	24 Volts	24V
GND	GROUND	Ground

The SmarTEST Digital I/O Front Panel (SDF03017) is connected to the digital I/O board and is placed at the backside of the SmarTEST ONE.

7 Analog Input/Output Module

Moog FCS offers 2 kind of analog I/O modules:

- 7.1 SAI 03180 8 channel analog inputs and 8 channel analog outputs
- 7.2 SAI 06220 16 channel analog inputs

The SSA06345 Strain gauge interface card is described in chapter 8

The SCV04280 Vibration Controller with 6 analog outputs is described in chapter 9 (not supported yet in software version 1.8.2)

The rotary address switch on the Analogue I/O module should be set to “0” (zero) when 1 analog I/O module is used. You can put more than 1 analogue I/O module in a 4 channel SmarTEST ONE, but there must be a minimum of one SCU in the SmarTEST ONE. The address switch of the second analog I/O module must be set to “1” on the PCB turn switch. The third analog I/O module address switch must set to “2” and so on. When an analog I/O board is delivered separately the operator should verify these correct settings before installing it in the SmarTEST X

Check if the Analog I/O board is recognized by the software after you startup the SmarTEST X system. You must see the message *"1 Analog I/O card(s) detected"* in the message pane (if you use one Analogue I/O module)

7.1 SAI 03180 Analog I/O module

This analog I/O module features 8 channel 16 bit analog inputs and 8 channel analog outputs. All analog outputs are guarded by a watchdog which will set the outputs to zero when the watchdog triggers. The analog I/O module features a similar safety port as the SCU cards which can be linked with the SCU safety bus, but this is not supported yet by the software. Currently the safety connector is designed to operate in the same way as the SCU is operating, but this is not implemented yet. To be completed with further software development.

The SmarTEST Analog I/O Front panel (SAI03180) is an analog interface for the SmarTEST ONE.

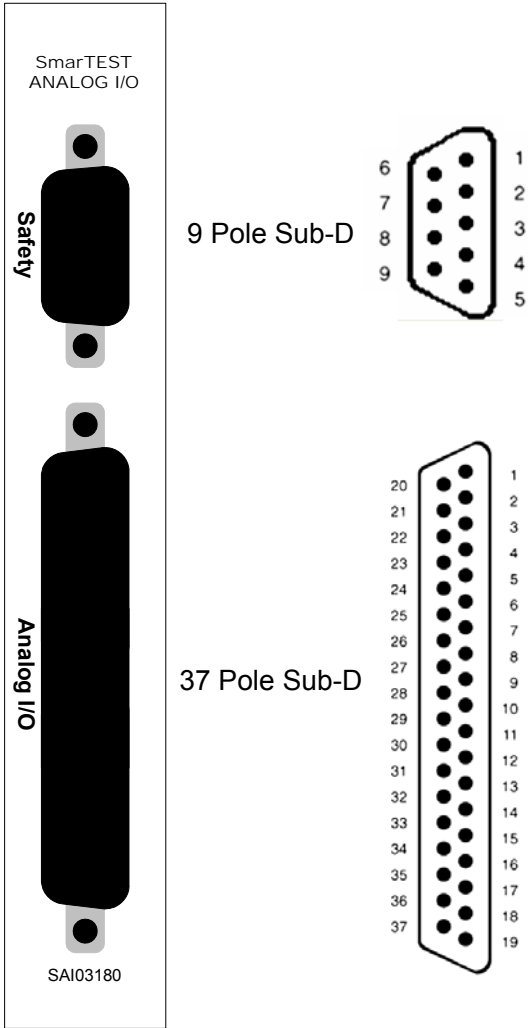


Figure 7.1 SmarTEST Analog I/O Front Panel SAI03180

The technical data of the Analog I/O module SAI03180 in detail:

Table 7.1 ADC SAI03180

Parameter	Value
16bit Analog / Digital Converters	8 ch.
Conversion rate	10 kHz
Differential Input range	+/- 10 VDC
Voltage Common Mode Range referred to analog ground	+/- 10 VDC

Table 7.2 DAC SAI03180

Parameter	Value
16bit Digital / Analog Converters	8 ch.
Conversion rate	10 kHz
Differential Output range	+/- 10 VDC
Single ended output referred to analogue ground	+/- 5 VDC
Watchdog protected	yes

For an example of measuring the differential DAC output see page 7-63

Table 7.3 Safety SAI03180

Parameter	Value
Opto isolated safety interface compatible with SCU safety link	yes

Table 7.4 Serial number SAI03180

Parameter	Value
Unique serial number	Readable by software

7.1.1 Analog I/O connector SAI 03180

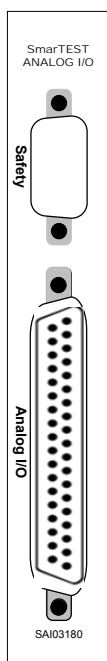


Table 7.5 SAI03180 Analog I/O Female connector (37-pins socket)

Pin	Signal Name	Description
1	+ AD0	+ AD converter 0
20	- AD0	- AD converter 0
2	+ AD1	+ AD converter 1
21	- AD1	- AD converter 1
3	+ AD2	+ AD converter 2
22	- AD2	- AD converter 2
4	+ AD3	+ AD converter 3
23	- AD3	- AD converter 3
5	+ AD4	+ AD converter 4
24	- AD4	- AD converter 4
6	+ AD5	+ AD converter 5
25	- AD5	- AD converter 5
7	+ AD6	+ AD converter 6
26	- AD6	- AD converter 6
8	+ AD7	+ AD converter 7
27	- AD7	- AD converter 7
9	AGND	Analogue Ground
28	AGND	Analogue Ground
10	+ VDAC0	+ V DAC 0
29	- VDAC0	- V DAC 0
11	+ VDAC1	+ V DAC 1
30	- VDAC1	- V DAC 1
12	+ VDAC2	+ V DAC 2
31	- VDAC2	- V DAC 2
13	+ VDAC3	+ V DAC 3
32	- VDAC3	- V DAC 3
14	+ VDAC4	+ V DAC 4

33	- VDAC4	- V DAC 4
15	+ VDAC5	+ V DAC 5
34	- VDAC5	- V DAC 5
16	+ VDAC6	+ V DAC 6
35	- VDAC6	- V DAC 6
17	+ VDAC7	+ V DAC 7
36	- VDAC7	- V DAC 7
18	AGND	Analogue Ground
37	RED_LED	RED_LED
19	WATCH_DOG_HP	WATCH_DOG_HP

7.1.2 Safety connector SAI 03180 (not supported yet)

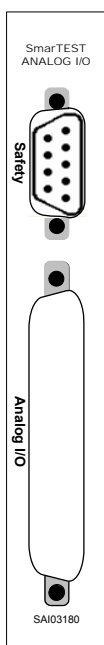


Table 7.6 SAI03180 Safety Female connector (9-pins socket)

Pin	Signal Name	Description
1	+ ERRMAN	+ ERRMAN
6	+ PRESSURESENSE	+ PRESSURE SENSE
2	+ BYPASS	+ BYPASS
7	+ MAINVALVE	+ MAIN VALVE
3	GND	Ground
8	- ERRMAN	- ERRMAN
4	- PRESSURESENSE	- PRESSURE SENSE
9	- BYPASS	- BYPASS
5	- MAINVALVE	- MAINVALVE

7.1.3 Example Analog output

When you setup the analog output according the description in the [User Manual](#) via a PseudoChannel and set (for instance) Output 1 of the analog IO to 100 (=100%), the output can be monitored by adding them to the graph or table in the STO. Both values will read 100.

If you want to measure this output look in table 7.1 analog I/O connector for the pin description to see what pins you must use to measure the output. For the analog signal from Analog output1 you can measure 10VDAC between +VDAC0 (pin10) and -VDAC0 (pin29), because when the Analog output via PseudoChannel is set to 100% and the +VDAC0 will be +5V and -VDAC0 will be -5V.

If you measure between +VDAC0 and the Analog Ground (pin 9 or 28) the difference will be + 5VDAC.

If you measure between -VDAC0 and the Analog Ground the difference will be -5VDAC.

If you want to measure an output of 2VDC first you must set the analog output for the PseudoChannel to 20% (if you measure between +VDAC and -VDAC) or to 40% (if you measure between +VDAC and AGND), then connect the Voltmeter to the correct pins of the 37 pin connector of the analog I/O front panel.

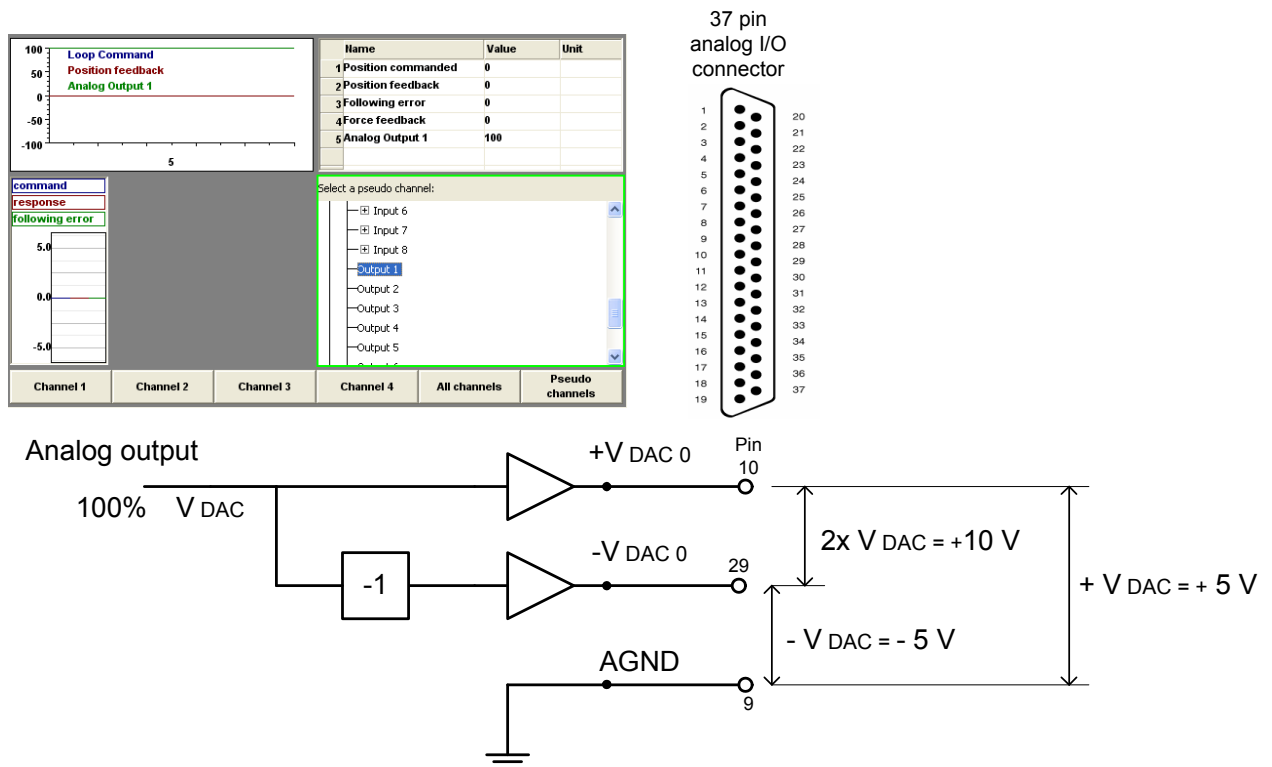


Figure 7.2 Analog output example for SAI03180

7.2 SAI 06220 Analog Input module

This analog Input module features 16 channel 16 bit analog inputs.
The SmarTEST Analog Front panel (SAI06220) is an analog interface for the SmarTEST X.

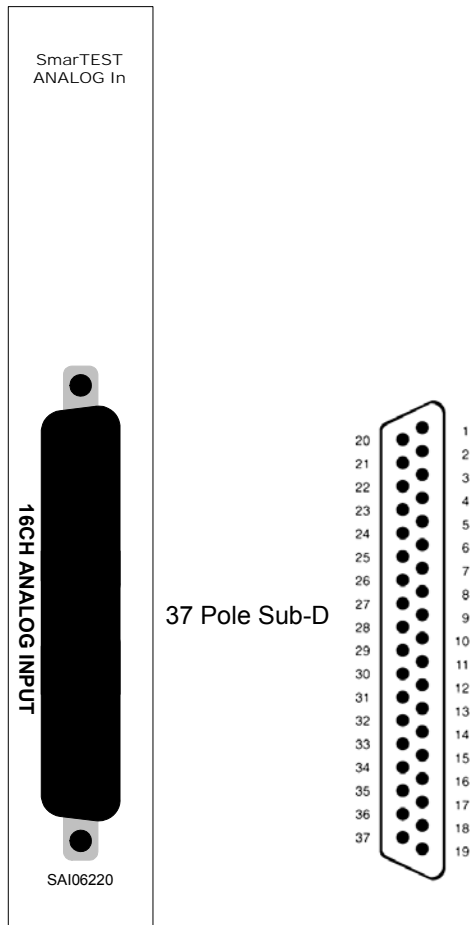


Figure 7.3 SmarTEST Analog Front Panel SAI06220

The technical data of the Analog Input module SAI06220:

Table 7.7 ADC SAI06220

Parameter	Value
16 bit Analog / Digital Converters	16 ch.
Conversion rate	10 kHz
Differential Input range	+/- 10 VDC
Voltage Common Mode Range +/-10V referred to analog ground	+/-10 VDC

Table 7.8 serial number SAI06220

Parameter	Value
Unique serial number	Readable by software

7.2.1 Analog Input connector SAI 06220

Table 7.9 SAI06220 Analog Input Female connector (37-pins socket)

Pin	Signal Name	Description
1	+ AD0	+ AD converter 0
20	- AD0	- AD converter 0
2	+ AD1	+ AD converter 1
21	- AD1	- AD converter 1
3	+ AD2	+ AD converter 2
22	- AD2	- AD converter 2
4	+ AD3	+ AD converter 3
23	- AD3	- AD converter 3
5	+ AD4	+ AD converter 4
24	- AD4	- AD converter 4
6	+ AD5	+ AD converter 5
25	- AD5	- AD converter 5
7	+ AD6	+ AD converter 6
26	- AD6	- AD converter 6
8	+ AD7	+ AD converter 7
27	- AD7	- AD converter 7
9 / 28	AGND	Analogue Ground
10	+ AD8	+ AD converter 8
29	- AD8	- AD converter 8
11	+ AD9	+ AD converter 9
30	- AD9	- AD converter 9
12	+ AD10	+ AD converter 10
31	- AD10	- AD converter 10
13	+ AD11	+ AD converter 11
32	- AD11	- AD converter 11
14	+ AD12	+ AD converter 12
33	- AD12	- AD converter 12
15	+ AD13	+ AD converter 13
34	- AD13	- AD converter 13
16	+ AD14	+ AD converter 14
35	- AD14	- AD converter 14
17	+ AD15	+ AD converter 15
36	- AD15	- AD converter 15
18	AGND	Analogue Ground
37	RED_LED	RED_LED
19	WATCH_DOG_HP	WATCH_DOG_HP

8 Strain gauge amplifier board

8.1 Introduction

The SSA06345 is a strain gauge interface card for an AT96 bus. The card is capable to interface up to 6 full, half and quarter bridge load cells. The card has internal bridge completion resistors of 350Ω and 120Ω. Each channel has shunt resistors for both compression and tension calibration. The AD converter is a delta sigma 24 bit, with software adjustable sample rate. The hardware gain is software adjustable. The excitation is software adjustable in two steps 2 or 10V. The sample rate is another adjustable item.

The SSA06345 has several options;

- Hardware gain, per channel adjustable
- Sample rate for all channels
- Excitation voltage level 2 or 10V, for all channels
- ¼, ½ or full bridge, for all channels

NOTE

*All channels have to be in the same bridge configuration.
The version 1.8 software doesn't support half and quarter bridges at this moment. Please contact Moog FCS for further information.*

Shunt calibration for all channels compression or tension

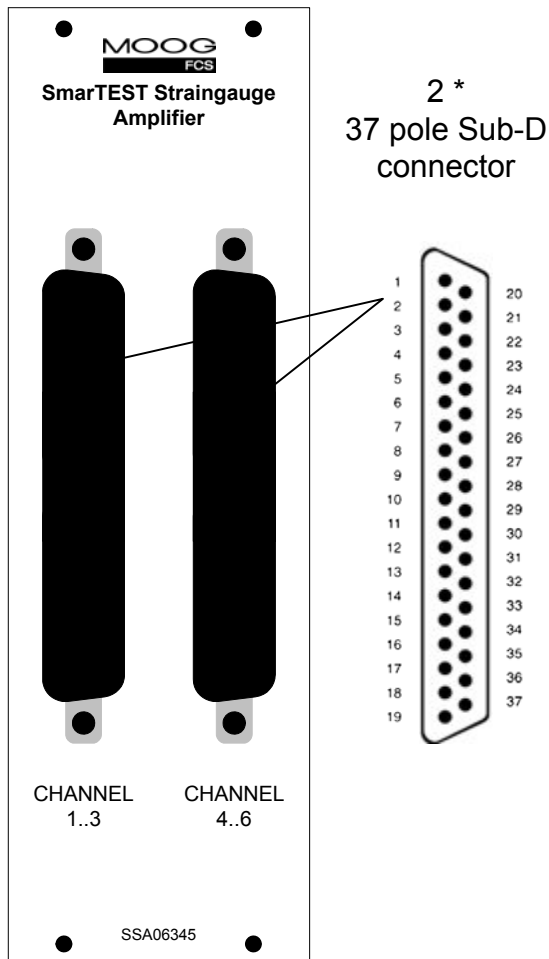


Figure 8.1 SSA06345 SmarTEST Strain gauge Amplifier Front Panel

8.2 Technical specifications

The technical data of the SSA06345 Strain Gauge Amplifier module:

Table 8.1 ADC SSA06345

Parameter	Value
24bit Analog / Digital Converters	6 ch.
Sample rate	10 kHz
Differential Input range	+/- 0.5 VDC

Table 8.2 Serial number SSA06345

Parameter	Value
Unique serial number	Readable by software

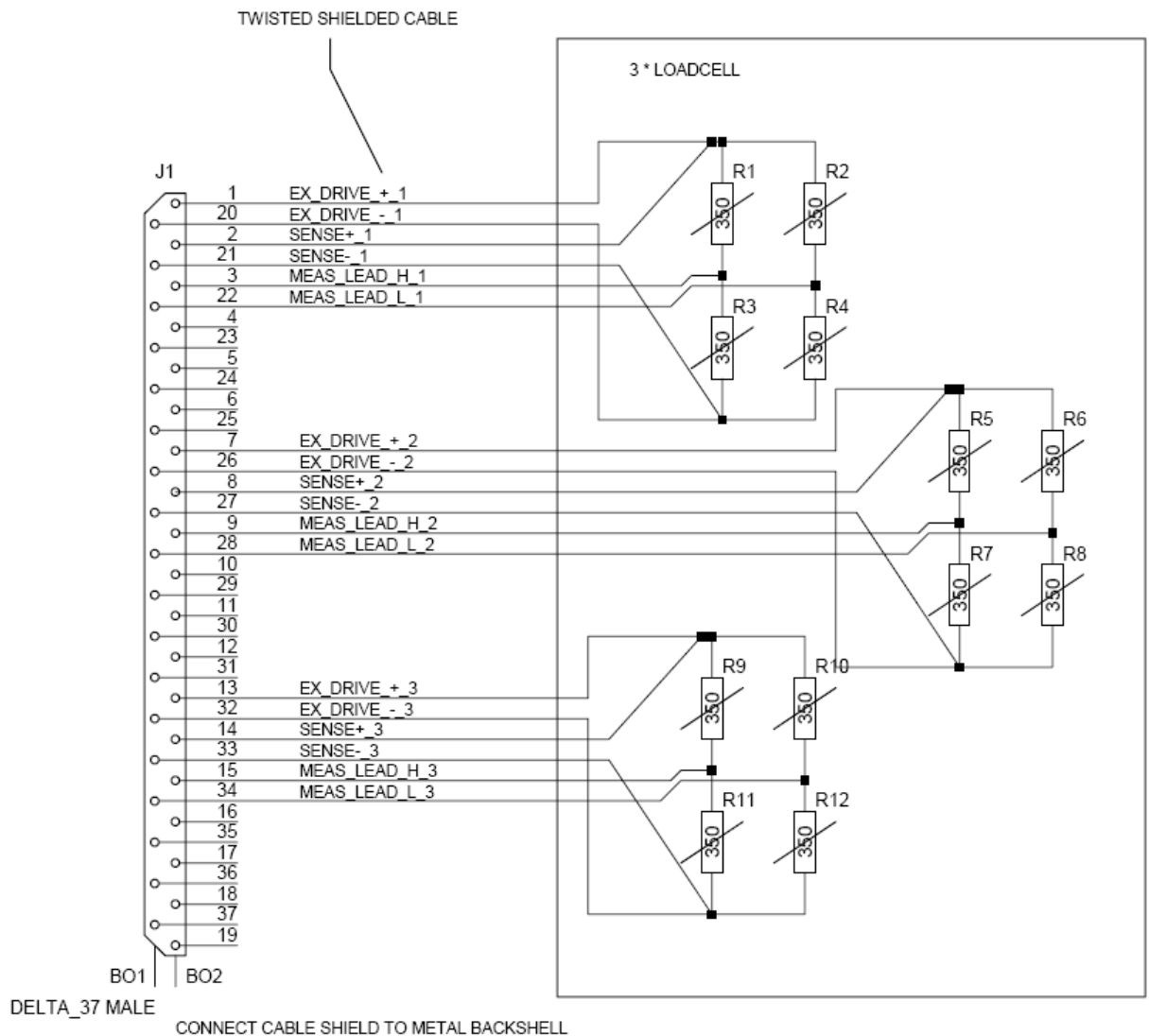


Figure 8.2 SSA06345 SmarTEST Strain Gauge Amplifier Connection Layout

8.2.1 Strain Gauge Amplifier connector SSA06345

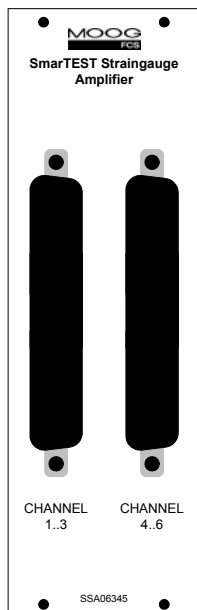


Table 8.3 SSA06345 SmarTEST Strain Gauge Amplifier connector (37-pins socket)

Pin	Signal Name	Description
1	EX_DRIVE+_1	Excitation Drive +1
20	EX_DRIVE_-_1	Excitation Drive -1
2	SENSE+_1	Excitation Sense +1
21	SENSE-_1	Excitation Sense -1
3	MEAS_LEAD_H_1	Measuring Lead High
22	MEAS_LEAD_L_1	Measuring Lead Low
4	NC	Not Connected
23	NC	Not Connected
5	NC	Not Connected
24	NC	Not Connected
6	NC	Not Connected
25	NC	Not Connected
7	EX_DRIVE+_1	Excitation Drive +1
26	EX_DRIVE_-_1	Excitation Drive -1
8	SENSE+_1	Excitation Sense +1
27	SENSE-_1	Excitation Sense -1
9	MEAS_LEAD_H_1	Measuring Lead High
28	MEAS_LEAD_L_1	Measuring Lead Low
10	NC	Not Connected
29	NC	Not Connected
11	NC	Not Connected
30	NC	Not Connected
12	NC	Not Connected
31	NC	Not Connected
13	EX_DRIVE+_1	Excitation Drive +1
32	EX_DRIVE_-_1	Excitation Drive -1
14	SENSE+_1	Excitation Sense +1
33	SENSE-_1	Excitation Sense -1
15	MEAS_LEAD_H_1	Measuring Lead High
34	MEAS_LEAD_L_1	Measuring Lead Low
16,17,18	NC	Not Connected
35,36,37	NC	Not Connected

9 SVC 04280 Vibration controller (NOT SUPPORTED in v1.8.2)

9.1 Introduction

The SVC 04280 signal conditioner is designed for operation with Integrated Circuit Piezoelectric (ICP®) force or strain sensors. The SVC 04280 conditions 6 ICP channels using BNC connectors.

This board also features 6 channel 16 bit analog outputs.

This SmarTEST Vibration Controller features a similar safety port as the SCU cards which can be linked with the SCU safety bus. Currently the safety connector is designed to operate in the same way as the SCU is operating, but this is not implemented yet. To be completed with further software development. For more information please contact Moog FCS Customer Support.

9.2 Technical specifications

- High Frequency Response max. 3 kHz
- Sampling rate 100kHz, downconverted to suit SmartestOne sampling rate
- Resolution 16bit
- Low Frequency Response, AC coupled (-5 %) 0.5 Hz
- Voltage Gain (Incremental Steps) x1, x10, x100
- Broadband Electrical Noise (1 Hz to 10 kHz) 20 μ V rms
- Discharge Time Constant (AC coupled) 1 sec

9.3 Physical appearance

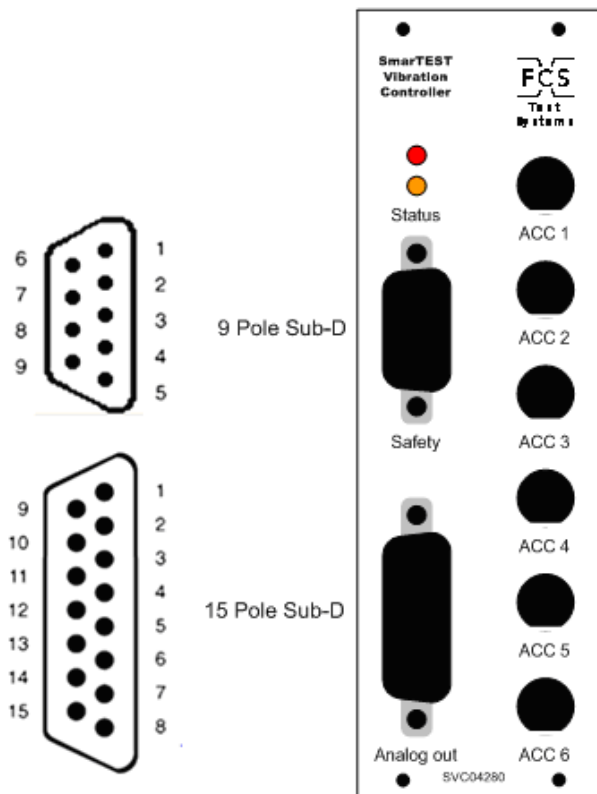


Figure 9-1 SmarTEST Vibration controller frontpanel SV04280C04280

9.4 Technical data

The technical data of the Vibration Controller module SVC 04280 in detail:

Table 9.1 ACC SVC 04280

Parameter	Value
ACC1 to 6	ICP®

ICP® is a registered trademark of PCB Group, inc., Depew, New York

Table 9.2 DAC SVC 04280

Parameter	Value
16bit Digital / Analog Converters	6 ch.
Conversion rate	10 kHz
Differential Output range	+10 VDC to -10 VDC
Single ended output using one output referred to analogue ground	+5 VDC to -5 VDC
Watchdog protected	yes

Table 9.3 Safety SVC 04280

Parameter	Value
Opto isolated safety interface compatible with SCU safety link	yes

Table 9.4 Eeprom SVC 04280

Parameter	Value
Eeprom for calibration data	16 kBit non volatile

SVC has the same flash as SCU so there is an Eeprom for calibration data.

Table 9.5 Serial number SVC 04280

Parameter	Value
Unique serial number	Readable by software

9.4.1 Analog output connector SVC04280

Table 9.6 SVC 04280 Analog Out Female connector (15-pins socket)

Pin	Signal Name	
1	+VDAC0	+ V DAC 0
9	-VDAC0	- V DAC 0
2	+VDAC1	+ V DAC 1
10	-VDAC1	- V DAC 1
3	+VDAC2	+ V DAC 2
11	-VDAC2	- V DAC 2
4	+VDAC3	+ V DAC 3
12	-VDAC3	- V DAC 3
5	+VDAC4	+ V DAC 4

Pin	Signal Name	
13	-VDAC4	- V DAC 4
6	+VDAC5	+ V DAC 5
14	-VDAC5	- V DAC 5
7	AGND	Analogue ground reference
15	AGND	Analogue ground reference
8	AGND	Analogue ground reference

9.4.2 Safety connector SVC 04280 (not supported yet)

Table 9.7 SVC 04280 Safety Female connector (9-pins socket)

Pin	Signal Name	
1	+ ERRMAN	+ ERRMAN
6	+ PRESSURESENSE	+ PRESSURE SENSE
2	+ BYPASS	+ BYPASS
7	+ MAINVALVE	+ MAIN VALVE
3	GND	Ground
8	- ERRMAN	- ERRMAN
4	- PRESSURESENSE	- PRESSURE SENSE
9	- BYPASS	- BYPASS
5	- MAINVALVE	- MAIN VALVE

10 Matrix Driver Unit

10.1 Introduction

The Matrix Driver Unit (MDU) (partnumber CA57401) can be used as device to connect the safety systems for user defined configurations in stations of the SmarTEST X. In the SmarTEST X system you can create your own station assignments and manage the associated safety system with the rotary switches on the MDU.

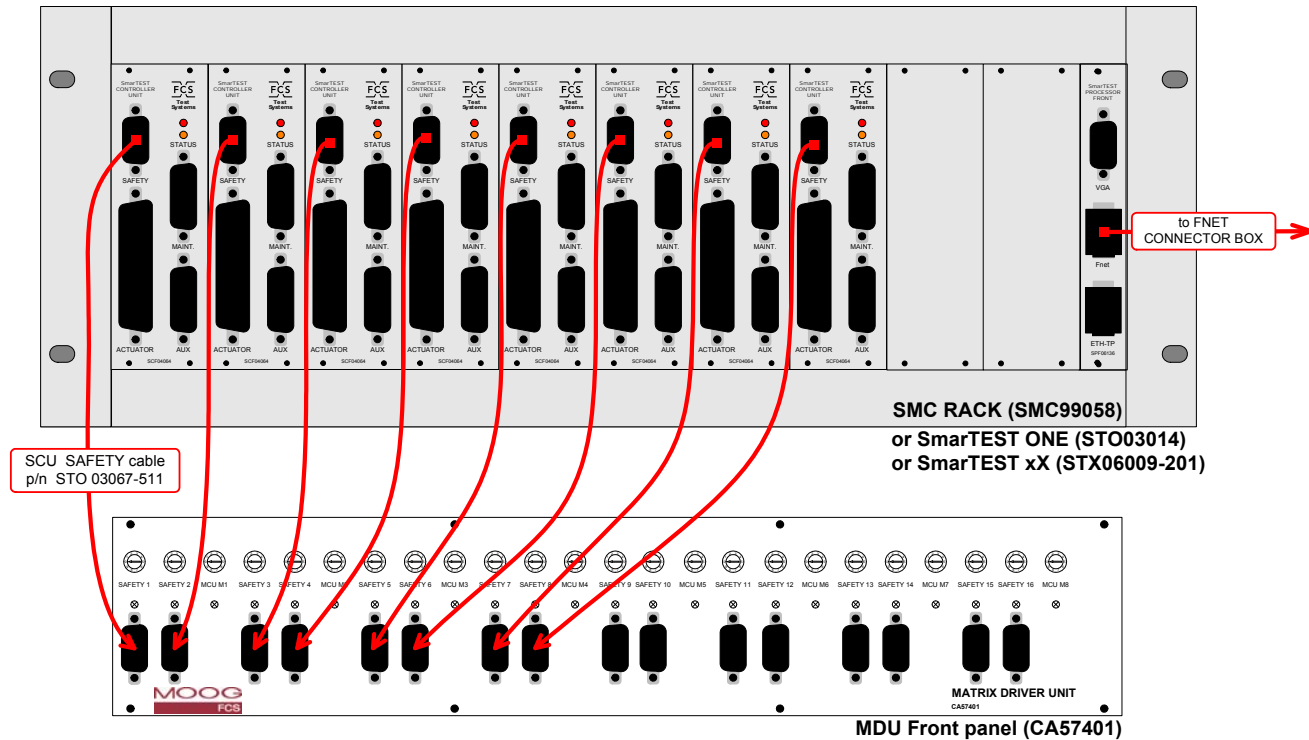


Figure 10.1 MDU frontside cable connection overview

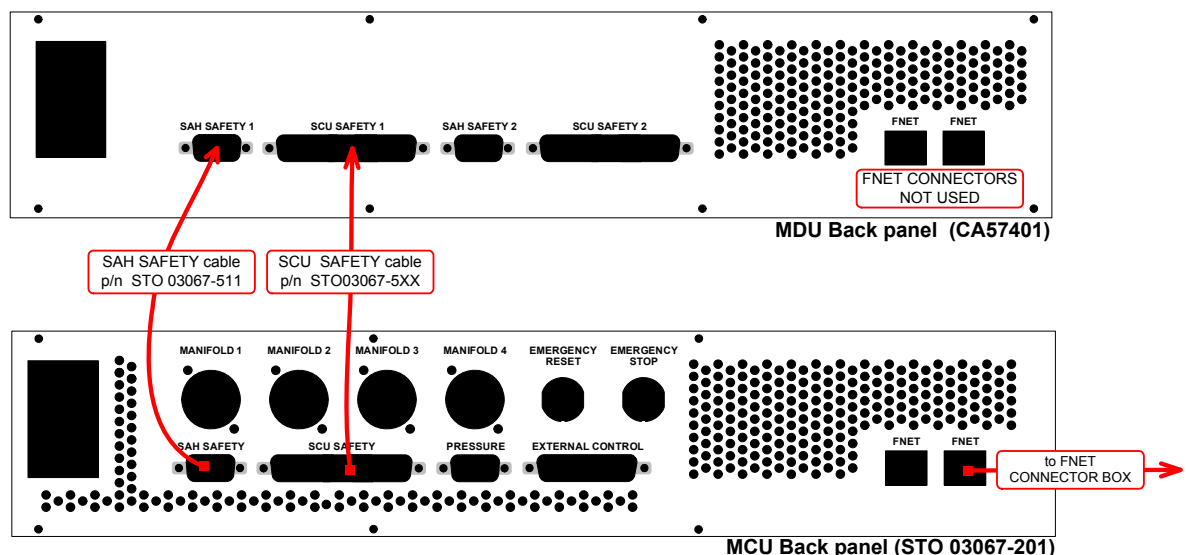


Figure 10.2 MDU backside cable connection overview

Schematic overview shows the FNET MCU (STO 03067-201), but the Digital I/O MCU (STO 03067) can also be used. In stead of the SMC rack also the SmarTEST ONE or the SmarTEST xX can be used.

Technical specifications

- 19" mountable panel 2U
- Preferred operation temperature between 0°C and 40 °C
- Maximum number of controllers linked to 1 MDU is 16
- Maximum number of manifolds linked to 1 MDU is 8
- Power supply needed AC 85~264V 4A (Auto-range), [47~63Hz; 0,15A @115V; 0,07A @230V]

Physical appearance

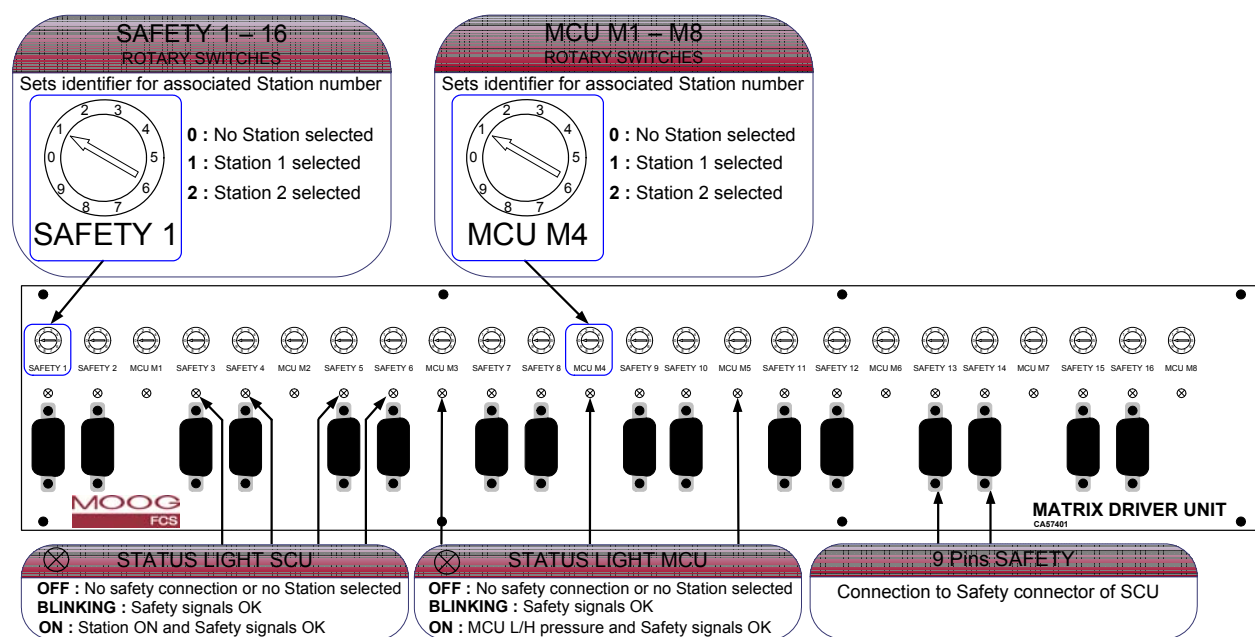


Figure 10.3 MDU front panel

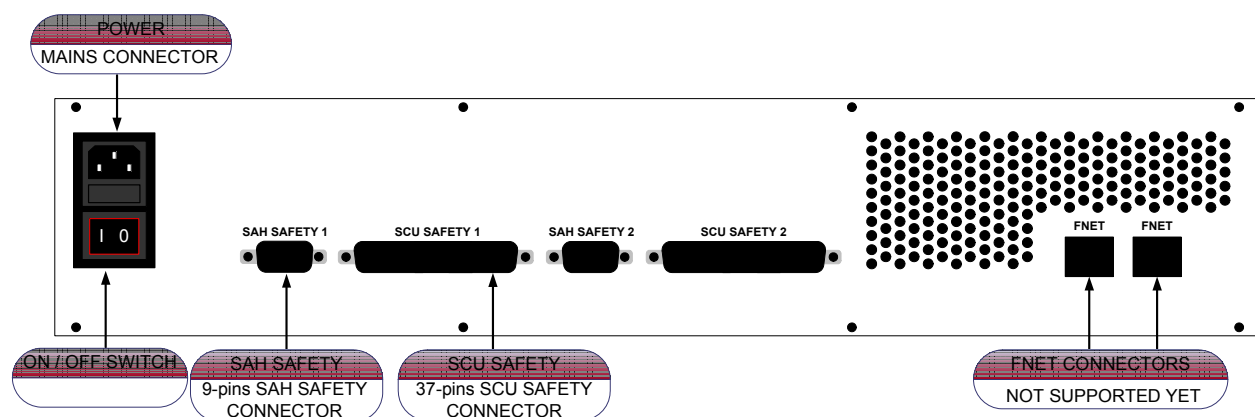


Figure 10.4 MDU back panel

The MDU can be used in combination with the Manifold Control Unit (p/n STO03067) and SmarTEST ONE (p/n STO03014), SmarTEST xX (p/n STX 06009-201) or SMC (p/n SMC99058)

Table 10.1 Partnumber Reference table MDU

Part number	Description	Remarks
STO03067	Dig I/O MCU	Max 2 Dig IO MCU's can be connected to the MDU
STO03067-201	Fnet MCU	Max 2 Fnet MCU's can be connected to the MDU
STO 03014	SmarTEST ONE	Standard STO (max 4 channels)
STX 06009-201	SmarTEST xX	SmarTEST xX system (max 16 channels can be connected to one MDU)
SMC 99058	SMC rack	Max 2 SMC racks with each 8 SCU controllers can be connected to one MDU
SCF xxxxx	SCU frontpanel	All SCU frontpanels types can be used in combination with the SCU controller cards (SCU04200 or SCU98049). Max 16 SCF safety connectors can be connected to MDU frontpanel.
STO03067-511	Safety cable (9 p)	Connects safety connectors of MDU front and SCF
STO03067-511	Safety cable (9 p)	Connects safety connectors of MDU backside and MCU (SAH)
	Safety cable (37p)	Connects safety connectors of MDU backside and MCU (SCU)

10.4 Functional description

On the front panel of the MDU connect the safety connectors with the safety cables (p/n STO03067-511) to the safety connectors of the SmarTEST Controller Unit (SCU) front panels as shown in [figure 10.1](#). The rotary switches (Safety 1-16) on the front panel of the MDU must be set with a small screwdriver to the station number of the associated channel. The rotary switches (MCU M1 to M8) must also be set to the station number of the associated MCU Manifold. The rotary switches on the MDU must be set to zero if no station with channel or MCU Manifold is assigned.

NOTE: After you change the station assignments with the rotary switches on the MDU check the SmarTEST X system that the channel and manifold assignments to the Stations correspond as set with the rotary switches on the MDU.

The red status lights on the frontpanel of the MDU can give the following indication:

Table 10.2 MDU SCU status light indication overview

STATUS LIGHT SmarTEST Controller Unit (SAFETY 1-16)	
Indication	Description
No light	Rotary switch indicator set to zero
No light	Rotary switch indicator set to non existing Station
No light	Safety cable not (properly) connected to safety connector SCU frontpanel
Slow blinking	Safety cable connected to SCU front
blinking	SCU signals (SCU OK, SCU ON, SCU NO-FAIL, SCU PWR) are OK
ON	Channel-Station assignment corresponds with rotary switch setting SCU signals (SCU OK, SCU ON, SCU NO-FAIL, SCU PWR) are OK Safety cable properly connected to SCU front

Table 10.3 MDU MCU status light indication overview

STATUS LIGHT Manifold Control Unit (MCU M1 – M8)	
Indication	Description
No light	Rotary switch indicator set to zero
No light	Rotary switch indicator set to non existing Station
No light	Safety cable not (properly) connected to SAH safety connector MCU
No light	Safety cable not (properly) connected to SCU safety connector MCU
blinking	Safety cables connected to MCU
ON	MCU Manifold to Station assignment corresponds with rotary switch setting LOW or HIGH pressure is set on MCU Manifold

On the backpanel of the MDU the connector for the power cable and the power ON/OFF switch can be found. The SAH SAFETY and SCU SAFETY connectors must be used to connect the (4 Manifolds) Manifold Control Unit (MCU) as shown in [figure 10.2](#). A second MCU unit can be connected to the MDU, then use the SAH SAFETY 2 and SCU SAFETY 2 connectors. If only one Manifold Control Unit is connected to the MDU, the connectors (SAH SAFETY 2 and SCU SAFETY 2) do not need a terminator connector. The two F-Net connectors at the backpanel of the MDU are not supported yet.

10.5 Electrical connections

In this section all the electrical connections of the MDU (CA57401) are given. For a description of the safety signals please refer to section 2.1 SAH Safety connector
For a schematic overview of the electrical connections see [Figure 10.5](#) at the end of this chapter

10.5.1 Safety link connectors

Table 10.4 SCU Safety Connector (9-pins sub-D female) on the MDU front panel

Pin	Signal	Description
1	No_Ext_Fail_L	No_External_Failure (Low)
2	On_Request_L	On Request (Low)
3	GND	Ground
4	Ext_Power_On_H	External Power On (High)
5	SCU_OK_H	SCU OK (High)
6	Ext_Power_On_L	External Power On (Low)
7	SCU_OK_L	SCU OK (Low)
8	No_Ext_Fail_H	No_External_Failure (High)
9	On_Request_H	On Request (High)

Table 10.5 SAH Safety Connector (9-pins sub-D female) on the MDU back panel

Pin	Signal	Description
1	No_Ext_Fail_L	No_External_Failure (Low)
2	On_Request_L	On Request (Low)
3	GND	Ground

Pin	Signal	Description
4	Ext_Power_On_H	External Power On (High)
5	SCU_OK_H	SCU OK (High)
6	Ext_Power_On_L	External Power On (Low)
7	SCU_OK_L	SCU OK (Low)
8	No_Ext_Fail_H	No_External_Failure (High)
9	On_Request_H	On Request (High)

Table 10.6 SCU Safety Connector (37-pins sub-D female) on MDU back panel

Pin	Signal	Description
1	SCU_OK_H	SCU 1 Output for SCU_OK monitoring
2	SCU_ON_H	SCU 1 Output for SCU_On_Request
3	NO_EXT_FAIL_H	SCU 1 Output for No_External_Failure
4	EXT_POWER_ON_H	SCU 1 Output for External_Power_On monitoring
5	GND	Ground
6	SCU_OK_H	SCU 2 Output for SCU_OK monitoring
7	SCU_ON_H	SCU 2 Output for SCU_On_Request
8	NO_EXT_FAIL_H	SCU 2 Output for No_External_Failure
9	EXT_POWER_ON_H	SCU 2 Output for External_Power_On monitoring
10	SCU_OK_H	SCU 3 Output for SCU_OK monitoring
11	SCU_ON_H	SCU 3 Output for SCU_On_Request
12	NO_EXT_FAIL_H	SCU 3 Output for No_External_Failure
13	EXT_POWER_ON_H	SCU 3 Output for External_Power_On monitoring
14	GND	Ground
15	SCU_OK_H	SCU 4 Output for SCU_OK monitoring
16	SCU_ON_H	SCU 4 Output for SCU_On_Request
17	NO_EXT_FAIL_H	SCU 4 Output for No_External_Failure
18	EXT_POWER_ON_H	SCU 4 Output for External_Power_On monitoring
19	NC	Not Connected
20	SCU_OK_L	SCU 1 Input from SCU for SCU_OK monitoring
21	SCU_ON_L	SCU 1 Input from SCU for SCU_On_Req monitoring
22	NO_EXT_FAIL_L	SCU 1 Input from SCU for No_Ext_Fail monitoring
23	EXT_POWER_ON_L	SCU 1 Input from SCU for External_Power_On monitoring
24	SCU_OK_L	SCU 2 Input from SCU for SCU_OK monitoring
25	SCU_ON_L	SCU 2 Input from SCU for SCU_On_Req monitoring
26	NO_EXT_FAIL_L	SCU 2 Input from SCU for No_Ext_Fail monitoring
27	EXT_POWER_ON_L	SCU 2 Input from SCU for External_Power_On monitoring
28	GND	Ground
29	SCU_OK_L	SCU 3 Input from SCU for SCU_OK monitoring

Pin	Signal	Description
30	SCU_ON_L	SCU 3 Input from SCU for SCU_On_Req monitoring
31	NO_EXT_FAIL_L	SCU 3 Input from SCU for No_Ext_Fail monitoring
32	EXT_POWER_ON_L	SCU 3 Input from SCU for External_Power_On monitoring
33	SCU_OK_H	SCU 4 Input from SCU for SCU_OK monitoring
34	SCU_ON_H	SCU 4 Input from SCU for SCU_On_Req monitoring
35	NO_EXT_FAIL_H	SCU 4 Input from SCU for No_Ext_Fail monitoring
36	EXT_POWER_ON_H	SCU 4 Input from SCU for External_Power_On monitoring
37	GND	Ground

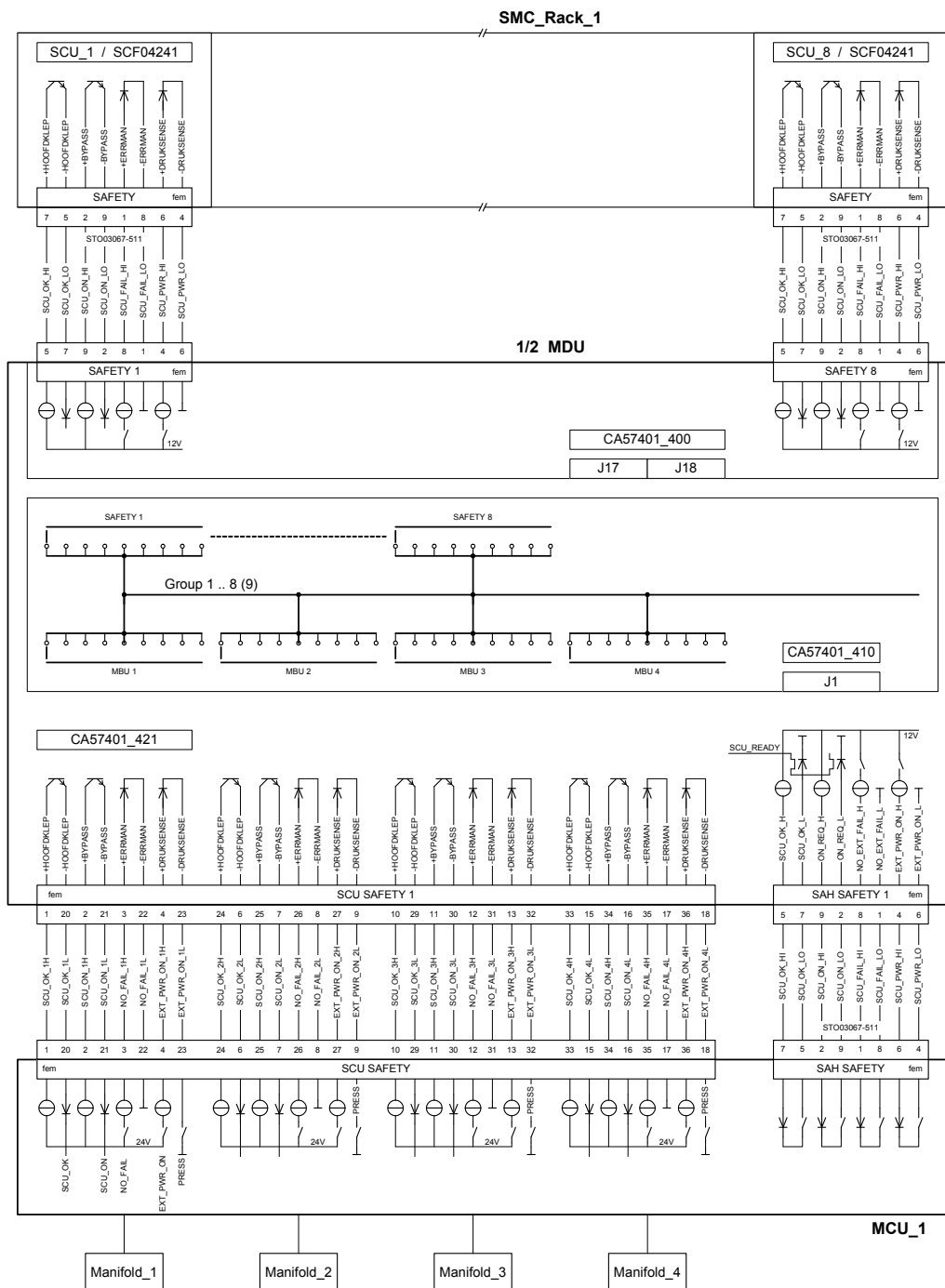


Figure 10.5 MDU electrical overview

11 Specifications Overview

11.1 SmarTEST ONE Controller Specifications

Table 11.1 SmarTEST ONE Specifications

Housing	<ul style="list-style-type: none"> • Can contain up to 4 channels • 19" desktop or rack mountable (450x177x280 mm) • Weight 9,2 kg • Integrated 640 x 480 full VGA color display • Input voltage: 90-132 / 180-264 VAC; 47-63Hz ; 10A@115V, 5A@230V, 400VA • 2 x 2 A @ 24 V Low / High Solenoid output
Servocontroller	<ul style="list-style-type: none"> • Up to 10kHz control loop (software selectable) • Moog FCS unique control loop • Three feedback control possibility (Force, Position, Acceleration) • Bumpless instant mode switching between Force and Position mode
Function generation	<ul style="list-style-type: none"> • Frequency range 0.01 to 500 Hz • Multi-channel function generation with user defined "mixer" functions (e.g. mix a low frequency offset with a higher frequency load) • Waveforms: sine,, sawtooth, block/square, ramp, rounded ramp, exponential, random** (psd frequency definition) • Analog input can be used as command • Complex simulation spectrum support • Constant amplitude and phase matching
Standard inputs (per channel)	<ul style="list-style-type: none"> • 2 x high resolution (0.003 %) with selectable gain and bridge excitation. • Pot meter input (0.003 %) (+/- 5V 5mA) or LVDT input (0.003%) with LVDT excitation(5V peak to peak @ 3kHz) • Encoder, absolute (SSI) max 32bit or relative 10 bit • 16 bit input (+/- 10V)
Standard outputs (per channel)	<ul style="list-style-type: none"> • 16 bits \pm 100 mA valve driver output, with a limit in software from 0 to 100% or (hardware selectable) +/- 10V output • 2 * 16 bit D/A converters, +/- 10 V
Optional items	<ul style="list-style-type: none"> • Manifold Control Unit with 4 On/Off for Low/High pressure valves (24VDC/2A each) • Digital I/O board containing 8 inputs and 8 outputs • Analog I/O board containing 8 inputs and 8 outputs • Accelerometer input board 6 channels • Add on board for 3 stage servovalve
Environment	<ul style="list-style-type: none"> • 10 to 40 degrees C. • Relative humidity: 10% to 85 % non-condensing

11.2 Transducer Specifications

Table 11.2 Transducer Specifications

Connection	Transducer
Double high resolution inputs with selectable gain and bridge excitation.	Loadcell (single or dual bridge) or two other resistance bridge type transducers (e.g. pressure transducers)
Pot meter position input with Pot excitation (+/- 5V 5mA). or LVDT input with LVDT excitation(5V peak to peak @ 3kHz)	LVDT or resistive (pot meter) or temposonic (external excitation)
16 bit input (+/- 10V)	Any electrically matching transducer. This input can also be used to connect an external function generator
16 bits 100 mA valve driver output, with a limit in software from 0 to 100% or (hardware selectable) +/- 10V output (optional 4-20 mA)	Servo valve or amplifier
2 * selectable 16 bit D/A converters	Any electrically matching device, e.g. oscilloscope or DVM. Internal parameters of the controller can be routed to these D/A converters

12 Troubleshooting

A number of common problems and checks have been listed for SmarTEST ONE hardware troubleshooting. If your problem is not listed, please contact MOOG FCS customer support.

12.1 Problem-remedy list

Table 12.1 Problem-remedy list

Indication	Probable Cause	Remedy
No display, no lights	Fuse burnt	Replace fuse.
Unit reports no controllers have been found.	Faulty SCU or analog card or wrong address switch settings.	Remove the front panels and check the address switch settings. If settings are OK replace the card.
Unit does not enable hydraulics and unit reports auxiliary hardware failure on one of the controllers	Safety cable not connected.	Connect safety cable (for all controllers used in the test).
	SSU switch in remote position	Place SSU switch in local position.
	Emergency button pressed.	Release emergency button.
	External interlock (pressure switch) open.	Connect pin 1 and 2 of the pressure switch input.
Unit reports self test failure on one of the controllers	Faulty SCU.	Replace the SCU card.
No message "SAH04086 board detected" in message pane	Faulty BIOS setting.	Set in BIOS (F2 after startup) via menu Advanced > I/O Device Config > Onboard LPT : [Enabled]. Exit BIOS save settings
Vservo output is limited to around +/- 3 volt	Iservo- and Iservo+ not connected with each other	Shorten + I servo and – I servo pins with each other, without connect the servo-drive to the STO, the \pm Vservo should reach ± 10 V.
	Actuator CV+ and GND pins to control the servo drive	Connect CV+ and CV- to the Vservo output of the SCU. Further connect the AGND of the SCU to the GND of the SV-drive
Numerical part of external keyboard do not work	Numerical keys of attached keyboard are not supported.	Use the numbers of the keyboard or the numeric keypad of the STO

13 Appendix A EMC certifications and compliances

Safety certifications and compliances

Meets intent of Directive 73/23/EEC as amendment by 93/68/EEC. Compliance was demonstrated to the specification

(EN61010:2001

EMC Compliance

Meets intent of Directive 89/336/EEC as amendment by 91/263/EEC 92/31/EEC 93/68/EEC. Compliance was demonstrated to the following specifications

(EN55022:1998

(EN55024:1198

Parts of

(EN61800-3:1996

(EN61000-3-2:2000

(EN61000-3-3:2000 for emission and immunity.

14 Appendix B List of Abbreviation

Abbreviation	
%	Percent
C	degrees Celsius
Cal.	Calculated
D/A	Digital/Analogue
DPI	Data Processing Interface
HZ	Hertz
kHz	kilo Hertz
LVDT	Linear Variable Displacement Transducer
mA	Milliampere
Max	Maximum
Min	Minimum
Mm	Millimeter
PIDF	Proportional, Integral, Derivative and Feed forward
POT	Potentiometer
PRT	Pseudo Real Time
SCU	SmarTEST Controller Unit
Sec.	Second
V	Volts
W x H x D	Width x Height x Depth

15 Appendix C LVDT compatibility list

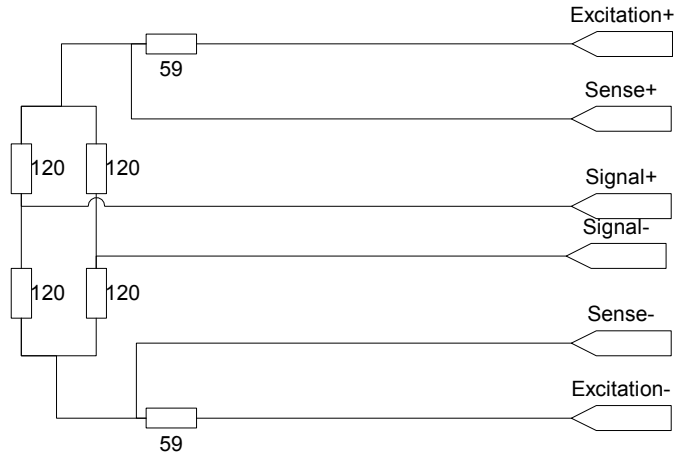
Manufacturer	Type	Mechanical Stroke [mm]	Sensitivity [mV/V(rms)/mm]	Full Scale Ratio Primary / Secondary	SCU gain full scale electrical stroke = 100%	Compatible
-----	LT1-60R	30	3.36	0.1008	13.14 %	YES
Macro Sensors	PR750-50	1.25	255	0.3187	4.15 %	YES
Macro Sensors	PR750-100	2.5	155	0.3875	3.42 %	YES
Macro Sensors	PR750-200	5	95	0.475	2.79 %	YES
Macro Sensors	PR750-500	12.5	25	0.3125	4.24 %	YES
Macro Sensors	PR750-1000	25	25	0.625	2.12 %	YES
Macro Sensors	PR750-2000	50	15	0.75	1.76 %	YES
Macro Sensors	PR750-3000	75	10	0.75	1.76 %	YES
Macro Sensors	PR750-4000	100	7.1	0.71	1.86 %	YES
Macro Sensors	PR750-5000	125	5.1	0.6375	2.08%	YES
Macro Sensors	PR750-7500	190	4.3	0.817	1.62 %	YES
Macro Sensors	PR750-10000	250	3.1	0.775	1.71%	YES
RDP	ACT500	12.5		0.8	1.65 %	YES
RDP	ACT1000	25		0.9	1.47%	YES
RDP	ACT2000	50		0.442	2.99%	YES
RDP	ACT3000	75				NO
RDP	ACT4000	100				NO
RDP	ACT6000	150				NO
RDP	ACT8000	200				NO
RDP	ACT10000	250				NO
RDP	ACT15000	375				NO
RDP	ACT 18500	470				NO
RDP	D5/300AG	7.5		0.442	2.99%	YES
Measurement Specialties	050 HR	1.27	230	0.2921	4.53 %	YES
Measurement Specialties	100 HR	2.54	165	0.4191	3.16 %	YES
Measurement Specialties	200 HR	5.08	91	0.46228	2.86 %	YES
Measurement Specialties	300 HR	7.62	51	0.38862	3.41 %	YES
Measurement Specialties	500 HR	12.7	25.6	0.32512	4.07 %	YES
Measurement Specialties	1000 HR	25.4	14.2	0.36068	3.67 %	YES

Measurement Specialties	2000 HR	50.8	8.3	0.42164	3.14 %	YES
Measurement Specialties	3000 HR	76.2	9.1	0.69342	1.91 %	YES
Measurement Specialties	4000 HR	101.6	7.1	0.72136	1.83 %	YES
Measurement Specialties	5000 HR	127	5.5	0.6985	1.89 %	YES
Measurement Specialties	7500 HR	190.5				NO
Measurement Specialties	10000 HR	254	2.8	0.7112	1.86 %	YES
Sensorex	Sx27RV120	60	2.546	0.15276	8.67 %	YES

NOTE *This list is not complete, for the latest information please check the MOOG website*

16 Appendix D Transducer connection examples

Sometimes there is a requirement to connect a **120 Ω load cell** to a SCU (either a 98 or 04 type). The 120 Ω load cell cannot be connected to the excitation. The current limits of the excitation drivers limit the voltage to 9.1958V. (A value calculated).



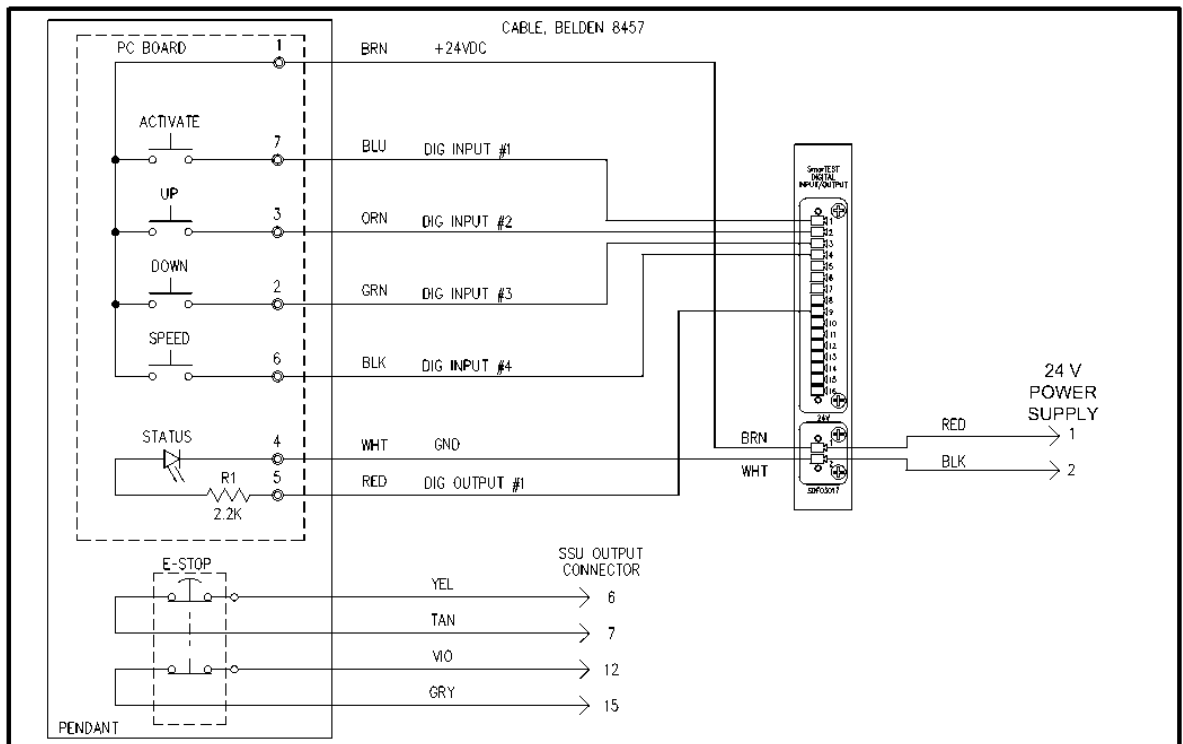
By placing two resistors in series, in the above schematic 59 Ω the current is limited. The resistor values are chosen to get 5V across the load cell. Sometimes the load cell manufacturer has compensation resistors in the load cell which increases the load cell impedance. Please check by an ohmmeter the resistance value, and change the series resistor if necessary. The resistor value is $\frac{1}{2}$ the load cell value measure across the excitation. The power value of series resistor is $\frac{1}{2}$ watt.

The above setup requires a software change. The SCU04200 regulated the voltage to 10V across the load cell. In the above case this must be 5V in case of the proposed setup. The users must choose between a direct connection and a connection with series resistors.

In both type SCU's 98 and 04 the ratio metric option must always be on. The calculated gain of the ratio metric module will be approximately being 2, which compensates the gain loss due to the 5V excitation in stead off the normal 10V.

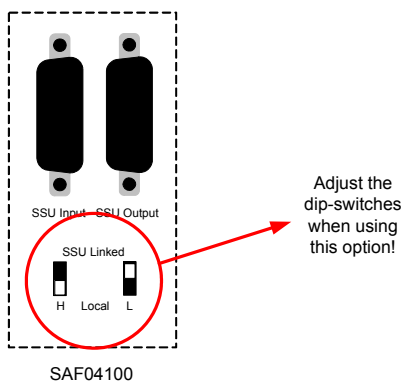
17 Appendix E Remote control cable diagram

In **chapter 5** the handheld remote (inching pendant) unit is described. This cable wiring diagram displays how a remote inching pendant is connected to the digital I/O board.



The external E-STOP on the pendant unit must be connected to the SSU Output (see description SSU Linked: L Local H) on the SAH of the SmarTEST ONE.

NOTE Make sure that the L dip switch of the SSU Output is set to SSU Linked (up) position as in the picture below.



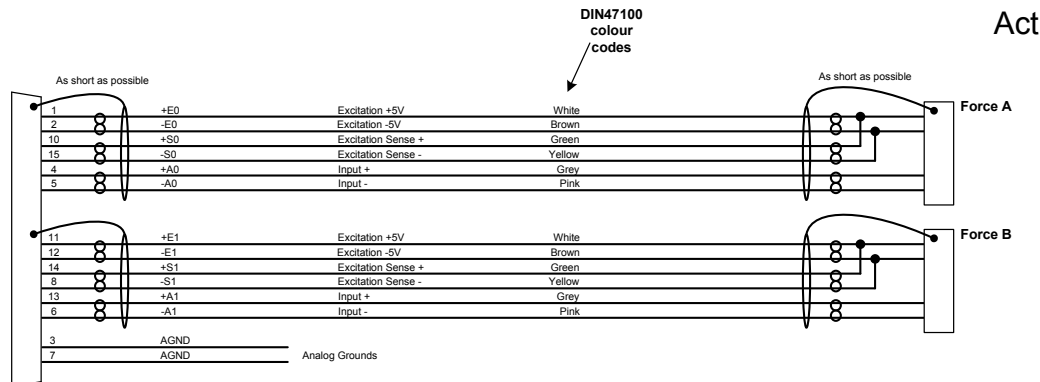
18 Appendix F Actuator cable examples

Example Actuator Cable for SCF04244 (MTS Style)

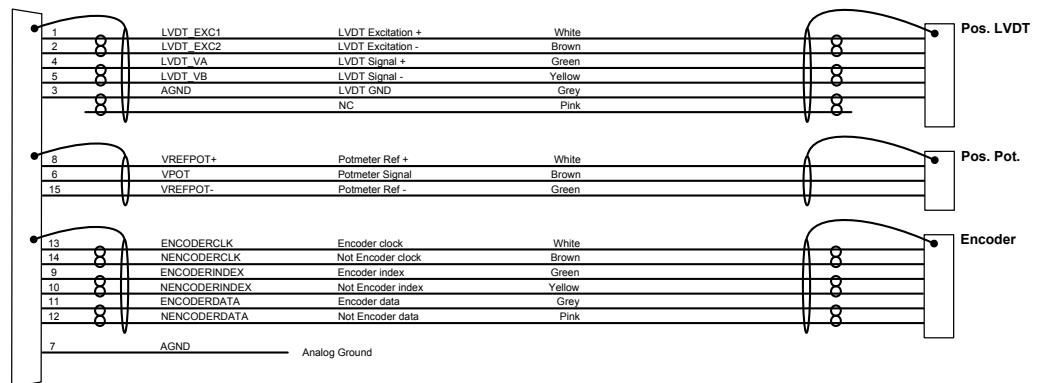
SCF04244
Frontpanel

Actuator

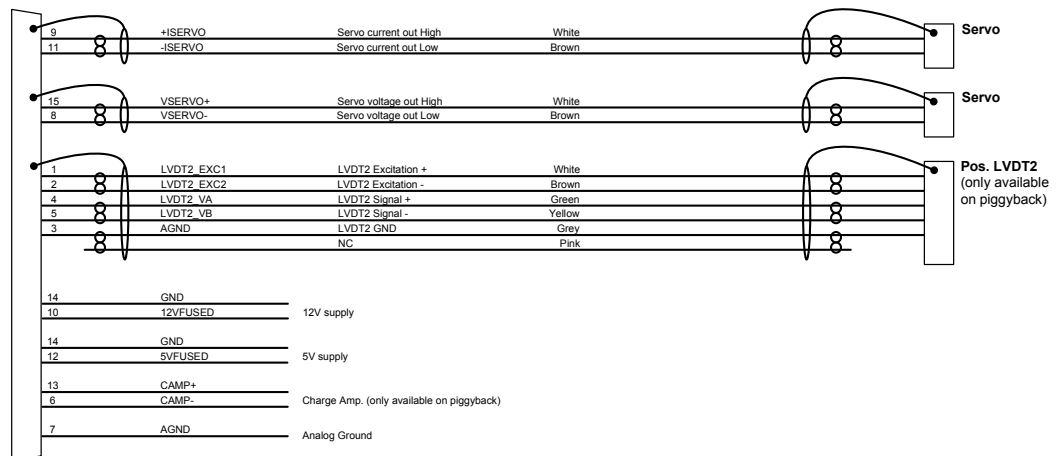
FORCE
15 pole
Sub-D male



POSITION
15 pole
Sub-D male



SERVO
15 pole
Sub-D male



Important!

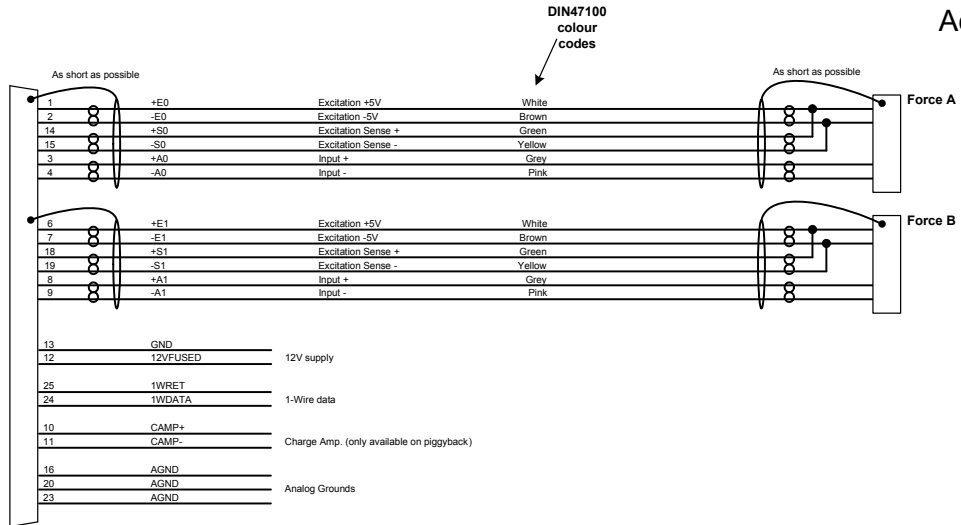
- All unused analog inputs must be connected to AGND:
Force A: Connect +A0 en -A0 to AGND, ALSO connect +S0 to +E0 and -S0 to -E0
Force B: Connect +A1 en -A1 to AGND, ALSO connect +S1 to +E1 and -S1 to -E1
LVDT: Connect LVDT_VA and LVDT_VB to AGND
Potmeter: Connect VPOT to AGND
Spare Analog Input: Connect +AD3 and -AD3 to AGND
- When using Vservo instead of Iservo then +ISERVO should be connected to -ISERVO

Example Actuator Cable for SCF04241

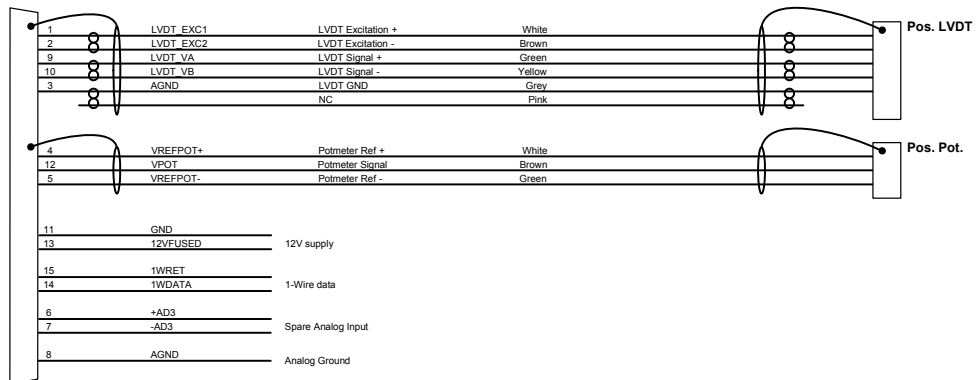
SCF04241
Frontpanel

Actuator

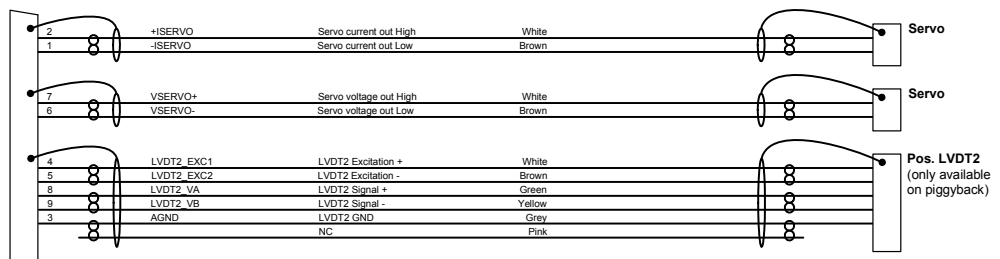
FORCE
25 pole
Sub-D male



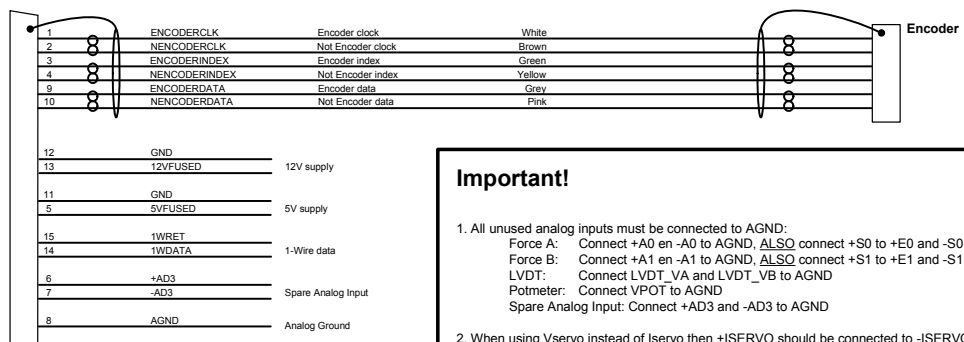
POSITION
15 pole
Sub-D male



SERVO
9 pole
Sub-D male



ENC
15 pole
Sub-D male



Important!

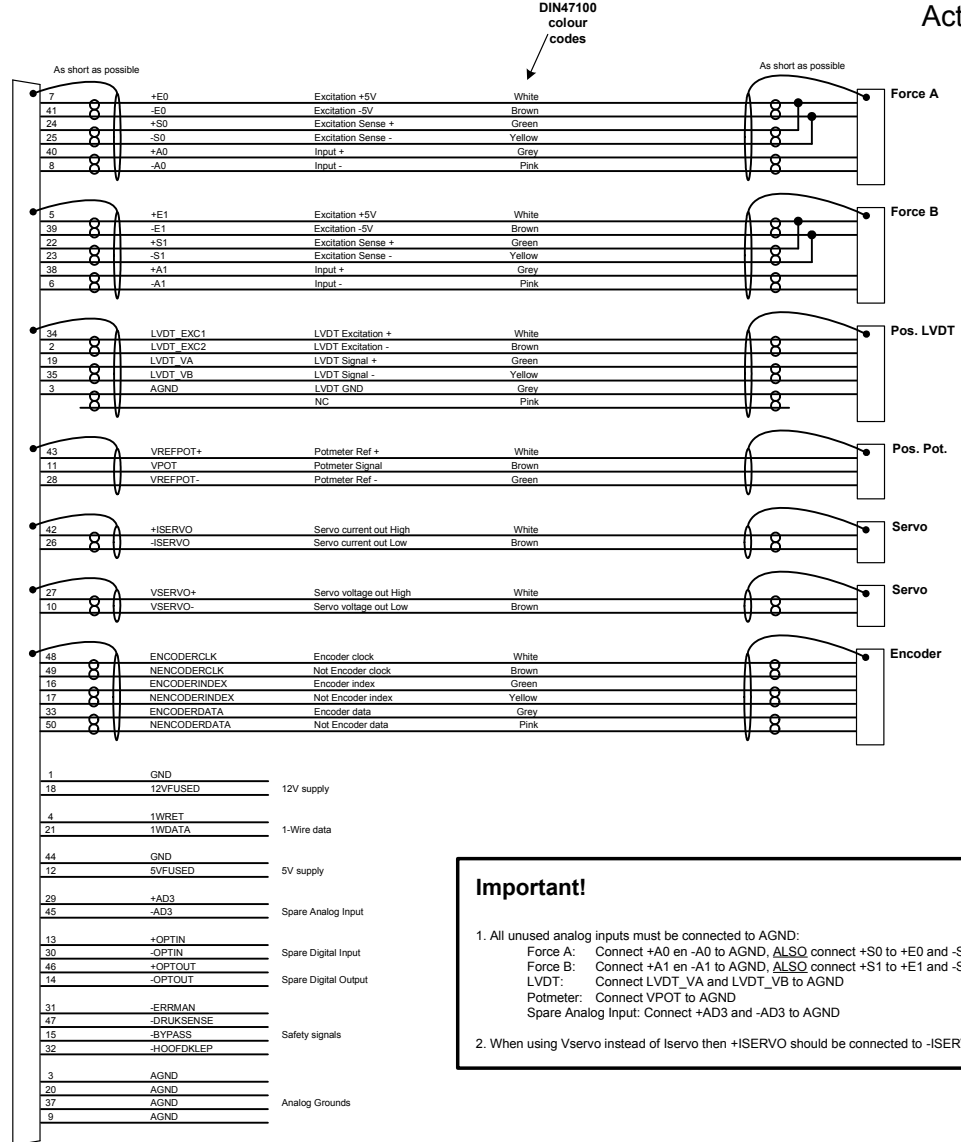
- All unused analog inputs must be connected to AGND:
 Force A: Connect +A0 en -A0 to AGND, ALSO connect +S0 to +E0 and -S0 to -E0
 Force B: Connect +A1 en -A1 to AGND, ALSO connect +S1 to +E1 and -S1 to -E1
 LVDT: Connect LVDT_VA and LVDT_VB to AGND
 Potmeter: Connect VPOT to AGND
 Spare Analog Input: Connect +AD3 and -AD3 to AGND
- When using Vservo instead of Iservo then +ISERVO should be connected to -ISERVO

Example Actuator Cable for SCF04064

SCF04064
Frontpanel

Actuator

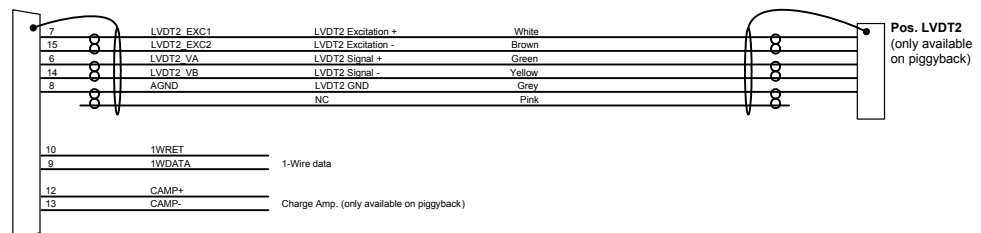
ACTUATOR
50 pole
Sub-D male



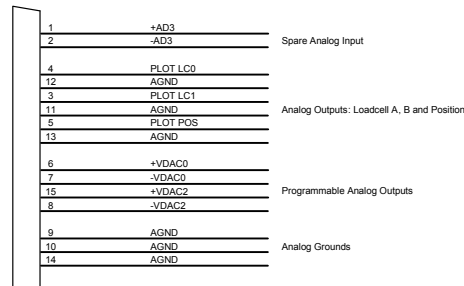
Important!

- All unused analog inputs must be connected to AGND:
 Force A: Connect +A0 en -A0 to AGND, ALSO connect +S0 to +E0 and -S0 to -E0
 Force B: Connect +A1 en -A1 to AGND, ALSO connect +S1 to +E1 and -S1 to -E1
 LVDT: Connect LVDT_VA and LVDT_VB to AGND
 Potmeter: Connect VPOT to AGND
 Spare Analog Input: Connect +AD3 and -AD3 to AGND
- When using Vservo instead of Iservo then +ISERVO should be connected to -ISERVO

AUX
15 pole
Sub-D male



MAINT
15 pole
Sub-D male



19 Appendix G BIOS settings

Janich & Klass CPU AMD K6-II 500 MHz and 32MB SDRAM (used in STO with s/n 0001 to 0050) [1 of 2]
Once powered on hit "DEL" to enter setup.

Menu	Item	Value
► Standard CMOS Setup	Hard disk	(Info in gray not changeable)
	IDE Primary Master	None
	IDE Primary Slave	32MB ATA Flash D
	IDE Secondary Master	None
	IDE Secondary Slave	None
	Drive A	None
	Drive B	None
	Video	EGA/VGA
	Halt op:	All, but Keyboard
► Advanced BIOS Features Setup	► CPU Feature	Press Enter (Thermal Monitor 1)
	CPU L1 & L2 Cache:	Enabled
	Quick Power On Self Test:	Enabled
	First Boot Device:	USB-HDD
	Second Boot Device:	HDD-0
	Third Boot Device:	USB-FDD
	Boot Other Device:	Enabled
	Swap Floppy Drive:	Disabled
	Boot Up Floppy Seek:	Disabled
	Boot Up NumLock Status:	On
	Gate A20 Option:	Fast
	Typematic Rate Setting:	Enabled
	Typematic Rate (Chars/Sec):	20
	Typematic Delay (Msec):	250
	Security Option:	Setup
	APIC Mode:	Enabled
	Report No FDD for Win95	No
► Advanced Chipset Features	DRAM Timing Selectable	By SPD
	X: CAS Latency Time:	2.5
	x: Active to Precharge Delay:	7
	x:DRAM RAS# o CAS# Delay:	3
	x:DRAM RAS# Precharge:	3
	DRAM Data Integrity Mode:	Non-ECC
	MGM Core Frequency:	Auto max 266 MHz
	Delayed Transaction:	Enabled
	** On Chip VGA Settings **	
	On-Chip VGA:	Enabled
	On Chip Frame Buffer Size:	4MB
	Boot Display:	CRT
► Integrated Peripherals	► On-Chip Primary IDE:	press <enter>
	On-Chip Primary PCI IDE:	Enabled
	IDE Primary Master PIO:	Auto
	IDE Primary Slave PIO:	Auto
	IDE Primary Master UDMA:	Disabled
	IDE Primary Slave UDMA:	Disabled
	On-Chip Secondary PCI IDE:	C
	X:IDE Primary Master PIO:	Auto
	X:IDE Primary Slave PIO:	Auto
	X:IDE Primary Master UDMA:	Auto
	X:IDE Primary Slave UDMA:	Auto
	IDE HDD Block Mode:	Enabled
	► Onboard Device:	press <enter>
	USB Controller:	Enabled
	USB 2.0 Controller:	Enabled
	USB Keyboard Support:	Disabled
	USB Mouse Support:	Disabled
	► Super IO Device:	press <enter>
	Onboard FDC Controller:	Disabled
	Onboard Serial Port 1:	3F8/IRQ4
	Onboard Serial Port 2:	2F8/IRQ3
	Onboard Parallel Port:	378/IRQ7
	Parallel Port Mode:	Printer
	X:ECP Mode Use DMA:	3
	** Clock / Frequency Control **	
	Spread Spectrum	-0.50%

Janich & Klass CPU AMD K6-II 500 MHz and 32MB SDRAM (used in STO with s/n 0001 to 0050) [2 of 2]

Menu	Item	Value
► Special Features	** On-board Static RAM **	
	Configuration	Disabled
	X: Access Rights:	read / write
	X: Memory Size:	16 kByte
	X: Memory Address:	DC000h
	X: I / O Address:	360h
	** On-Board IDE-Flash**	
	Access Rights:	read / write
	** ISA-Timing**	
	ISA Cycle-Time:	240 ns
	** Onboard GPLED Function**	
	► General Purpose LED 1	press <enter>
	Status:	Always on
	(IRQ3- Batt low in gray marked with dash (-))	
	► Board information	press <enter>
► Power Management Setup		
	ACPI Function:	Enabled
	Power Management:	User Defined
	Video Off Method:	DPMS
	Video Off In Suspend:	Yes
	Suspend Type:	Stop Grant
	MODEM Use IRQ:	3
	Suspend Mode:	Disabled
	HDD Power Down:	Disabled
	** Reload Global Timer Event **	
	Primary IDE 0:	Disabled
	Primary IDE 1:	Disabled
	Secondary IDE 0:	Disabled
	Secondary IDE 1:	Disabled
	FDD , COM , LPT Port:	Disabled
	PCI PIRQ [A-D]#	Disabled
► PCI/PNP Configuration		
(Caution: All settings must be identical as shown below;		
	Reset Configuration Data	Disabled
	Resources Controlled by	Manual
	► IRQ Resources	press <enter>
	IRQ-3 assigned to:	PCI/ISA PnP
	IRQ-4 assigned to:	PCI/ISA PnP
	IRQ-5 assigned to:	Legacy ISA
	IRQ-7 assigned to:	Legacy ISA
	IRQ-9 assigned to:	PCI/ISA PnP
	IRQ-10 assigned to:	PCI/ISA PnP
	IRQ-11 assigned to:	PCI/ISA PnP
	IRQ-12 assigned to:	Legacy ISA
	IRQ-14 assigned to:	PCI/ISA PnP
	IRQ-15 assigned to:	Legacy ISA
	► DMA Resources	press <enter>
	DMA-0 assigned to:	PCI/ISA PnP
	DMA-1 assigned to:	PCI/ISA PnP
	DMA-3 assigned to:	PCI/ISA PnP
	DMA-5 assigned to:	PCI/ISA PnP
	DMA-6 assigned to:	PCI/ISA PnP
	DMA-7 assigned to:	PCI/ISA PnP
	PCI / VGA Palette Snoop	Disabled
Save & Exit	To save all settings press	
	<enter>	
	<y>	
	<enter>	
	Reboot automatically	

Kontron ETX CPU board, Intel Pentium III 1.1GHz 512MB RAM (used in STO with s/n 0051 to 0185) [1 of 2]

Menu		Menu-items	Value
(Info in gray not changeable)			
Main		System Time	[HH:MM:ss]
		System Date	[MM/DD/YYYY]
		Legacy Diskette A	[Disabled]
		Legacy Diskette B	[Disabled]
		► Primary Master	[Auto]
		► Primary Slave	[None]
		► Secondary Master	[None]
		► Secondary Slave	[None]
		SMART Device Monitoring	[Enabled]
		System Memory	640 KB
		Extended Memory	502 MB
Advanced	► Advanced Chipset Control	Enabled memory gap	[Disabled]
		Graphics Engine 1	[Enabled]
		Graphics Engine 2	[Enabled]
		Graphics Memory	[UMA = 8MB]
		Assign IRQ to VGA	[Yes]
Advanced	► PCI/PNP Configuration	PNP OS installed	[No]
		Reset Configuration Data	[No]
		Secured Setup Configuration	[Yes]
		► PCI Device, Slot #1	
		Option ROM Scan:	[Enabled]
		Enable Master:	[Disabled]
		Latency Timer:	[Default]
		► PCI Device, Slot #2	
		Option ROM Scan:	[Enabled]
		Enable Master:	[Disabled]
		Latency Timer:	[Default]
		► PCI Device, Slot #3	
		Option ROM Scan:	[Enabled]
		Enable Master:	[Disabled]
		Latency Timer:	[Default]
		► PCI Device, Slot #4	
		Option ROM Scan:	[Enabled]
		Enable Master:	[Disabled]
		Latency Timer:	[Default]
		PCI IRQ line 1	[Auto Select]
		PCI IRQ line 2	[Auto Select]
		PCI IRQ line 3	[Disabled]
		PCI IRQ line 4	[Disabled]
		Onboard LAN IRQ line	[10]
		Onboard USB EHCI IRQ line	[Disabled]
		► PCI/PNP ISA IRQ Resource Exclusion	
		IRQ 3:	[Available]
		IRQ 4:	[Available]
		IRQ 5:	[Available]
		IRQ 7:	[Available]
		IRQ 9:	[Available]
		IRQ 10:	[Available]
		IRQ 11:	[Available]
		IRQ 15:	[Available]
		Default Primary Videocard	[PCI]
Advanced	► Memory Cache	Memory Cache	[Enabled]
		Cache System BIOS area	[Write Protect]
		Cache Video BIOS area	[Write Protect]
		Cache Base 0-512k	[Write Back]
		Cache Base 512k-640k	[Write Back]
		Cache Extended Memory Area	[Write Back]
		Cache D000 - D3FF	[Disabled]
		Cache D400 - D7FF	[Disabled]
		Cache D800 - DBFF	[Disabled]
		Cache DC00 - DFFF	[Disabled]
Advanced	► I/O Device Configuration	Local Bus IDE adapter	[Primary]
		Primary IDE UDMA66/100	[Enabled]
		USB UHCI Host Controller 1	[Disabled]
		Legacy USB Support	[Disabled]
		AC97 Audio controller	[Disabled]
		Onboard LAN controller	[Enabled]
		Onboard LAN PXE ROM	[Disabled]
		Serial port A	[Disabled]
		Serial port B	[Disabled]
		Onboard LPT	[Enabled]
		Mode	[Output only]
		Base I/O address	[378]
		Interrupt	[IRQ]

Kontron ETX CPU board, Intel Pentium III 1.1 GHz 512MB RAM (used in STO s/n 0051 to 0185) [2 of 2]

Menu		Menu-items	Value
Advanced	► Keyboard Features	NumLock	[On]
		Key Click	[Disabled]
		Keyboard auto-repeat rate	[30/sec]
		Keyboard auto-repeat delay	[1 sec]
Advanced	► Hardware Monitor	VCC 3.3V Voltage	
		CPU Core Voltage	
		5Vsb Voltage	
		Battery Voltage	
		CPU Temperature	
Advanced	► Watchdog Settings	Mode	[Disabled]
	► Display Control	Display Mode	[CRT + LFP]
		JDA Revision	1.4
		Flat Panel Type	[Auto]
		Flat Panel Scaling	[Centered]
		Flat Panel Backlight	[128]
Advanced	► Miscellaneous	Floppy Check	[Disabled]
		Summary screen	[Disabled]
		Quickboot Mode	[Enabled]
		Extended Memory Testing	[Just zero it]
		Dark Boot	[Enabled]
		Halt On Errors	[No]
		PS/2 Mouse	[Disabled]
		Large Disk Access Mode	[DOS]
		Spread Spectrum	[Disabled]
Security		Supervisor Password Is	Clear
		User Password Is	Clear
		Set Supervisor Password	[Enter]
		Set User Password	[Enter]
		Diskette access	[Supervisor]
		Fixed disk boot sector	[Normal]
		Virus check reminder	[Disabled]
		System backup reminder	[Disabled]
		Password on boot	[Disabled]
Power		Enable ACPI	[No]
		Automatic Thermal Control Circuit	[TM2]
		Max CPU frequency	[1100MHz]
		Power Savings	[Disabled]
		Hard Disk Timeout	[Disabled]
		Resume On Modem Ring	[Off]
		Resume On Time	[Off]
		Resume Time	[00:00:00]
		Power supply	[AT]
		Power Button Function	[Power Off]
		Power Loss Control	[Last State]
Boot		Boot priority order:	1: IDE 0:
			2:
			3:
			4:
			5:
			6:
			7:
			8:
		Excluded from boot order:	IDE 1:
			IDE 2:
			IDE 3:
			USB FDC:
			USB HDD:
			USB CDROM:
			USB ZIP:
			USB LS120:
			USB KEY:
			USB BEV:
			USB SCSI:
			USB CD:
			Bootable Add-in: Cards:
Exit		Exit Saving Changes	
		Exit Discarding Changes	
		Load Setup Defaults	
		Discard Changes	
		Save Changes	

Janich & Klass CPU AT96 M4/103 1.8 GHz and 768MB RAM (used in STO with s/n 0186 to 02XX) [1 of 3]

A monitor and keyboard must be connected and then the power can be switched on.

Once powered on hit "DEL" to enter setup.

Menu	Menu-items	Value
<i>(Info in gray not changeable)</i>		
► Standard CMOS Setup	Date (mm:dd:yy)	
	Time (hh:mm:ss)	
	► IDE Primary Master	None
	IDE HDD Auto-Detection	Press Enter
	IDE Primary Master	Auto
	Access Mode	Auto
	Capacity	
	Cylinder	
	Head	
	Precomp	
	Landing Zone	
	Sector	
	► IDE Primary Slave	None
	► IDE Secondary Master	None
	► IDE Secondary Slave	None
	Drive A	None
	Drive B	None
	Video	EGA/VGA
	Halt On	All, But Keyboard
	Base Memory	640 K
	Extended Memory	781312K
	Total Memory	782336K
► Advanced BIOS Features Setup	► CPU Feature	Press Enter (Thermal Monitor 1)
	Thermal Management	Thermal Monitor 1
	x CPU Operating Point	600 MHz
	x CPU Core Voltage	0.988 V
	CPU Operating Point (EST)	1.8 GHz
	CPU Core Voltage (EST)	1.340 V
	CPU L1 & L2 Cache	Enabled
	Quick Power On Self Test	Enabled
	First Boot Device	USB-HDD
	Second Boot Device	HDD-0
	Third Boot Device	USB-FDD
	Boot Other Device	Enabled
	Swap Floppy Drive	Disabled
	Boot Up Floppy Seek	Disabled
	Boot Up NumLock Status	On
	Gate A20 Option	Fast
	Typematic Rate Setting	Enabled
	Typematic Rate (Chars/Sec)	20
	Typematic Delay (Msec):	250
	Security Option:	Setup
	APIC Mode:	Enabled
	Report No FDD for WIN 95	No
► Advanced Chipset Features	DRAM Timing Selectable	By SPD
	X: CAS Latency Time:	2.5
	x: Active to Precharge Delay:	7
	x:DRAM RAS# to CAS# Delay:	3
	x:DRAM RAS# Precharge:	3
	DRAM Data Integrity Mode:	Non-ECC
	MGM Core Frequency:	Auto max 266 MHz
	Delayed Transaction:	Enabled
	** On Chip VGA Settings **	
	On-Chip VGA:	Enabled
	On Chip Frame Buffer Size:	4MB
	Boot Display:	CRT DVI LFP

Janich & Klass CPU AT96 M4/103 1.8 GHz and 768MB RAM (used in STO with s/n 0186 to 02XX) [2 of 3]

Menu	Menu-items	Value
► Integrated Peripherals	► On-Chip IDE Device:	Press <Enter>
	On-Chip Primary PCI IDE:	Disabled
	X:IDE Primary Master PIO:	Auto
	X:IDE Primary Slave PIO:	Auto
	X:IDE Primary Master UDMA:	Auto
	X:IDE Primary Slave UDMA:	Auto
	On-Chip Secondary PCI IDE:	Disabled
	X:IDE Secondary Master PIO:	Auto
	X:IDE Secondary Slave PIO:	Auto
	X:IDE Secondary Master UDMA:	Auto
	X:IDE Secondary Slave UDMA:	Auto
	IDE HDD Block Mode:	Enabled
	► Onboard Device:	Press <Enter>
	USB Controller:	Enabled
	USB 2.0 Controller:	Enabled
	USB Keyboard Support:	Disabled
	USB Mouse Support:	Disabled
	► Super IO Device:	Press <Enter>
	Onboard FDC Controller:	Disabled
	Onboard Serial Port 1:	3F8/IRQ4
	Onboard Serial Port 2:	2F8/IRQ3
	Onboard Parallel Port:	378/IRQ7
	Parallel Port Mode:	PRINTER
	X:ECP Mode Use DMA:	3
	** Clock / Frequency Control **	
	Spread Spectrum	-0.50%
► Special Features	** On-board Static RAM **	
	Configuration	Disabled
	X: Access Rights:	read / write
	X: Memory Size:	16 kByte
	X: Memory Address:	DC000h
	X: I / O Address:	360h
	** On-Board IDE-Flash**	
	Access Rights:	read / write
	** ISA-Timing**	
	ISA Cycle-Time:	240 ns
	** Onboard GPLED Function**	
	► General Purpose LED 1	Press <Enter>
	Status:	Always on
	X: IRQ3	
	X: IRQ4	
	X: IRQ5	
	X: IRQ7	
	X: IRQ9	
	X: IRQ10	
	X: IRQ11	
	X: Rx COM1	
	X: Tx COM1	
	X: Rx COM2	
	X: Tx COM2	
	X: Battery Low	
	► Board Information	Press <Enter>
	** Onboard Revision/Status**	
	Hardware Revision	00h
	CPU-module Revision	00h
	FPGA Revision	01h
	Battery Voltage	OK
	** Onboard Configuration**	
	Onboard SCRAM Size	1 Mbyte
	Onboard Jumper 1	Open
	Onboard Jumper 2	Open
	Keyboard connected over	Rear-Panel
	** Onboard Adapter**	
	Rear I/O Type	00
	COM2 Submodule	None
	Extension Module	Adapter installed

Janich & Klass CPU AT96 M4/103 1.8 GHz and 768MB RAM (used in STO with s/n 0186 to 02XX) [3 of 3]

Menu	Menu-items	Value
► Power Management Setup		
	ACPI Function:	Enabled
	Power Management:	User Define
	Video Off Method:	DPMS
	Video Off In Suspend:	Yes
	Suspend Type:	Stop Grant
	MODEM Use IRQ:	3
	Suspend Mode:	Disabled
	HDD Power Down:	Disabled
	** Reload Global Timer Event **	
	Primary IDE 0:	Disabled
	Primary IDE 1:	Disabled
	Secondary IDE 0:	Disabled
	Secondary IDE 1:	Disabled
	FDD , COM , LPT Port:	Disabled
	PCI PIRQ [A-D]#	Disabled
► PnP/PCI Configuration		
	Reset Configuration Data	Disabled
	Resources Controlled by	Manual
	► IRQ Resources	Press <Enter>
	IRQ-3 assigned to:	PCI/ISA PnP
	IRQ-4 assigned to:	PCI/ISA PnP
	IRQ-5 assigned to:	Legacy ISA
	IRQ-7 assigned to:	Legacy ISA
	IRQ-9 assigned to:	PCI/ISA PnP
	IRQ-10 assigned to:	PCI/ISA PnP
	IRQ-11 assigned to:	PCI/ISA PnP
	IRQ-12 assigned to:	Legacy ISA
	IRQ-14 assigned to:	PCI/ISA PnP
	IRQ-15 assigned to:	Legacy ISA
	► DMA Resources	Press <Enter>
	DMA-0 assigned to:	PCI/ISA PnP
	DMA-1 assigned to:	PCI/ISA PnP
	DMA-3 assigned to:	PCI/ISA PnP
	DMA-5 assigned to:	PCI/ISA PnP
	DMA-6 assigned to:	PCI/ISA PnP
	DMA-7 assigned to:	PCI/ISA PnP
	PCI / VGA Palette Snoop	Disabled
► PC Health Status		
	Shutdown CPU Temperature	Disabled
	CPU Temperature	
	Ambient Temperature	
	PCB Temperature	
	VCore	
	+ 1.25V (DDR-Term.)	
	+ 1.5V	
	+ 3.3V (internal)	
	+ 5V	
	+ 12V	
	+ 1.05 V (VCCPSB)	
	+ 1.35 V (VCore855)	
	Current CPU fan speed	
	aux. FAN 2	
Load Fail-Safe Defaults		
Load Optimized Defaults		
Set Supervisor Password		
Set User Password		
Save & Exit Setup		
Exit Without Saving		

20 Appendix H SAH fuse replacement

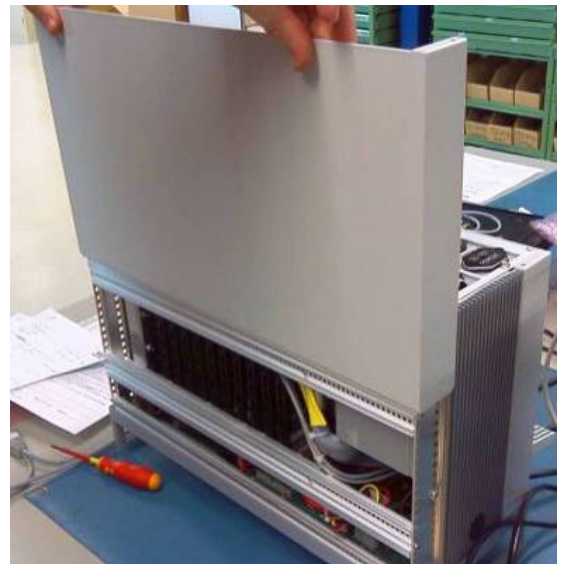
To replace the SAH fuses of the SmarTEST ONE perform the actions as described below:

- (First make sure that the power of the SmarTEST ONE is off (switch at the backside of the unit). Remove the power cable.
- (Make also sure that you are connected to an ESD safe GND, so no ESD voltages will affect the hardware.

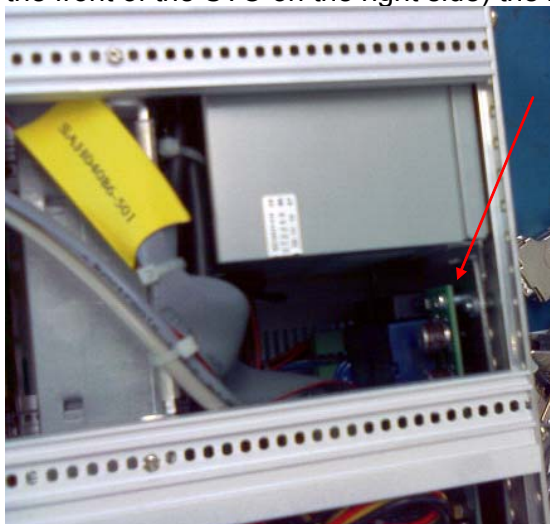
Put the SmarTEST ONE on the front side on the brackets (display down)
Unscrew the 4 hexagon (\square 2,5) screws from the back of the STO unit



Remove the outside cover (on top of the STO) by carefully pulling the outside cover.



Put the SmarTEST ONE back to the normal position. Behind the power supply unit (looked from the front of the STO on the right side) the 2 fuses of the SAH panel are located.



The fuses are behind the 2 black caps you can see in the picture below.



Replace the fuses with a **2 A quick glass fuse**.

Put the 2 black fuse caps back on the the fuses, and assemble the STO according this description in reversed order.